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[FROM THE EDITOR

The Fires of Creationists, and Rallying for Science

You have to hand it to the creationists, especially the "young-Earth" variety. They are endlessly creative in concocting new rationales for their worldviews. Even when they have to twist into mental contortions, they manage to say it all with a straight face. For example, if, as they contend, the Earth is only six thousand years old, instead of 4.6 billion, and if all life were created the same day instead of evolved over time, that means dinosaurs and humans lived at the same time. And if that's true, then maybe dragon legends actually are evidence of human contact with dinosaurs. And so if they can only show that dinosaurs breathed fire. . . . Yes, I know. Impossibilities multiplied by implausibilities. But these people are serious. They write school textbooks endorsing these absurdities. So for our cover article, Philip J. Senter takes them seriously. A vertebrate paleontologist, he carefully examines each hypothesis, one after the other. Senter has great patience. But the end result is a fire hose of cold water quenching each fire-breathing hypothesis. Where then do dragon legends come from? Senter explains that too. In a shorter companion article, he then tracks down a separate bizarre claim that Australian Aborigines may have known of the extinct plesiosaur. I'll not give away the ending, but think Golden Books.

And so it goes. We examine extraordinary claims. One after another. Patiently. Some may seem trivial. Others are far more serious. But they exist all along one continuum, and we are there with our scientists and investigators at every point. Then we report to you what the scientific evidence actually reveals. We also examine broader issues, including the flaws in our thinking that lead us to wrong conclusions about the world. An example in this issue is Terence Hines's essay-review of an important new book on why it is so hard for us to properly evaluate risks. Why do we give too much credence to some risks and too little to others? It's both a fascinating and crucially important topic. We have false problems and real problems. Not seeing the difference is costing us mightily.

* * *

The shame is that we needed a March for Science. But we did. What's encouraging is that scientists and science supporters turned out in huge numbers April 22 for rallies in more than 600 cities worldwide. They advocated for all the qualities of science we admire. In previous generations, our political leaders extolled science and did what they could to support it. Today, too many now in positions of power and influence belittle science. They demean evidence-based thinking, learning, even intelligence. Science is not partisan. It is our engine of progress. It is one of humanity's great achievements. The big turnout on its behalf reminds us all that science and critical thinking still have broad public support. The participants illuminated the darkness. Let's not let that light dim. (For a different take on the march, see Matthew Nisbet's column, p. 18.)

* * *

I hope you have noticed that beginning early this year we have had a "new" columnist, James ("The Amazing") Randi. As you all know, Randi has been one of the world's outstanding skeptics for more than four decades. He is one of our founders. He has written for SI over the years, but, amazingly (!), this is his first regular column for us. He has titled it "A Magician in the Lab." His third entry, "The Farce Known as 'FC,'" is in this issue. We're happy Randi is now bringing you his keen insights and investigatory experiences. Better late than never, I say.

—KENDRICK FRAZIER

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Academies Report Urges Bolstered Efforts to Protect Integrity of Science

Kendrick Frazier

The scientific enterprise places high value on honesty and openness. These and other values serve it well. Nevertheless, a variety of challenges to the integrity of scientific research have been cause for much recent soul-searching.

There is growing concern, for example, that substantial percentages of published results in some fields, biomedicine and psychology in particular, are not reproducible. In the meantime, new deleterious practices have arisen, such as predatory new journals that do little or no peer review or quality control and yet charge authors big fees. And retractions of scientific papers are rising. These are just three of the problems addressed in *Fostering Integrity in Research*, a 284-page report by the Committee on Responsible Science of the National Academies of Sciences, Engineering, and Medicine. The study was sponsored by a number of science-oriented agencies.

"The research enterprise is not broken, but it faces significant challenges in creating the conditions needed to foster and sustain the highest standards of integrity," said Robert Nerem (Georgia Institute of Technology), chair of the committee. He called on everyone involved in science to "take deliberate steps to strengthen the self-correcting mechanisms that are part of research…"

The report endorses the definition of scientific misconduct in the 1992 Academies report *Responsible Science*: "fabrication, falsification, or plagiarism in proposing, performing, or reporting research." However, many other practices that fall short of fabrication, such as misleading use of statistics and failure to retain and share research data, have been categorized as "questionable" practices. The report says these should now be considered "detrimental" research practices and strongly shunned.

Journals and research institutions both have a responsibility to curb irresponsible or abusive actions. The report says they should go beyond simple compliance with federal regulations to instead monitor research conduct and sustain the highest standards. In addition, good faith whistleblowers who raise concerns about the integrity of research must be protected and their concerns addressed fairly, thoroughly, and in a timely manner according to the report.

The fact that a growing percentage of recently published research turns out to be not reproducible is one of the report's main concerns.

The report says standards for transparency in many fields do not adequately support reproducibility and the ability to build on previous work. All information needed for a person knowledgeable about the field to reproduce the reported results must be made available at the time of publication or shortly after, the report says. This has been a long-standing problem in some fields (see adjacent story, "A Scientist Pushes Psychology Journals toward Open Data"). The new report says funding agencies and other sponsors should allocate funds to enable the long-term storage, archiving, and access to datasets and codes necessary to replicate findings.

The fact that a growing percentage of recently published research turns out to be not reproducible is one of the report's main concerns. The rising irreproducibility of published results is a complex phenomenon. While a certain level of irreproducibility due to unknown variables or errors is a normal part of research, the report says data falsification and detrimental research practices such as inappropriate use of statistics or after-the-fact fitting of hypotheses to previously collected data also play a role.

Researchers should routinely disclose all statistical tests carried out, including negative findings, the report says. It points to studies showing that scientific publications are biased against presenting negative results and that publication of negative results is on the decline. But there are powerful reasons for publishing negative results, the report emphasizes. Routine reporting of negative results helps avoid unproductive duplication of research and makes research spending more productive. Also, publishing negative results can prompt questioning of established paradigms, leading ultimately to groundbreaking new discoveries. Everyone involved should support and encourage this level of transparency, the report maintains.

On the problem of a rising number of retractions of journal articles due to research misconduct, the report cautions that this may not be due to a rise in the rate of misconduct; a more vigilant scrutiny by the scientific community could contribute. But there is no doubt that for a variety of reasons, "research misconduct and detrimental research practices are becoming more visible and attracting more attention" (p. 65).

While most of the report focuses on the institutional duties of research organizations, funding agencies, and scientific journals, it also challenges individual scientists to uphold the highest level of conduct possible. "Each individual retains deeply personal obligations and

duties to aspire to the highest levels of rigor in his or her work," the study says (p. 65). These include "understanding about cognitive biases and errors" to build in precautions against favoring existing ideas. Personal biases, interests of funders, and the reward systems surrounding the pursuit of science also must be considered.

The *Fostering Integrity in Research* report may or may not help restore public trust in science, now under attack from many quarters.

Another issue addressed is authorship. The report calls on scientific societies and journals to develop clear authorship standards based on the principle that those who have made a significant intellectual contribution are authors. All authors should approve the final manuscript. Gift or honorary authorship, coercive authorship, or ghost authorship should all be universally condemned, says the report.

The report calls for a new independent nonprofit organization, a Research Integrity Advisory Board, to be set up. It would work with all parties to promote high ethical standards and minimize research misconduct and detrimental research practices.

The report may or may not help restore public trust in science, now under attack from many quarters. But by reemphasizing the need for new institutional practices for self-examination and quality-control, it shows that scientific leaders are aware of the new challenges to research integrity and are striving to make changes to minimize them.

The new report can be downloaded or read online at https://www.nap.edu/catalog/21896/fostering-integrity-in-research.

Kendrick Frazier is editor of the SKEPTICAL INQUIRER.

A Scientist Pushes Psychology Journals toward Open Data

Tomasz Witkowski

The March 9 *Nature* reported some disturbing news: "An editor on the board of a journal published by the prestigious American Psychological Association (APA) has been asked to resign in a controversy over data sharing in peer review." The controversy arose when psychologist Gert Storm declared that he would review only papers whose data he could see. His declaration is not some whim of a fractious scientist. He is one of a few hundred scientists to proclaim that, starting in 2017, they will begin rejecting papers whose authors refuse to publicly share the underlying data or explain why they can't. But the story of Gert Storms and other scientists asking for data to be shared is not a new phenomenon.

It has been more than a half a century since Leroy Wolins, a psychologist from Iowa State University, authorized one of his students to write a letter to thirty-seven authors of original research articles asking them to submit the raw data that their studies were based on. The student intended to make practical use of the data in a study of his own. Out of thirty-seven authors, thirty-two replied to the request. However, twenty-one of those thirty-two researchers who replied informed "with tremendous regret" that their data had been accidentally destroyed, lost, or archived in such a way that it was impossible to retrieve. Only nine researchers (24 percent of the initial group) appeared to be willing to make their data available. Wolins, an expert in statistics, took a closer look at the data received and concluded that only seven of them met the requirements of what we might call a reliable statistical analysis (Wolins 1962). Surprised by the scientists' responses, Wolins described the experience in *American Psychologist*, thus triggering a heated scientific debate over the availability of raw data.

In 1973, James R. Craig and Sandra C. Reese decided to replicate Wolins's "accidental" study. They thoroughly planned and designed a new study to check whether there had been any improvement in the availability of raw data since Wolins's attempt more than a decade earlier. They asked fifty-three researchers to provide them with the raw data that they had used in their research. The results were more optimistic than those presented by Wolins. Nine researchers refused to reveal the data, claiming it had been lost, destroyed, or was otherwise unavailable. Only about half of the researchers declared their readiness to cooperate. Twenty of them sent analyzed or summarized data. Seven declared they would cooperate but only under certain conditions (Craig and Reese 1973).

Warren Eaton, a scientist from the University of Manitoba, reported even more optimistic results in 1984. His success rate of 73.5 percent (twenty-five of thirty-four) was much better than that of Wolins and Craig and Reese (Eaton 1984). However, in 2006, a group of Dutch psychologists from Amsterdam obtained diametrically opposite results, virtually identical to those of Wolins from 1962. In an attempt to reanalyze data sets to assess the robustness of the research findings, they contacted 141 authors of 249 studies. They received thirty-eight positive answers and managed to obtain actual data sets from sixty-four studies. This figure represents 25.7 percent of the total number of 249 data sets; 73 percent of the authors did not share their data (Wicherts et al. 2006).

Inspired by the examples of Wolins and other researchers, I decided to replicate their studies on my own. To do so, I randomly selected fifty empirical studies, all published in the past twelve months. I requested that the authors share the raw data from their studies. Out of fifty requests, I received twenty-seven replies, which accounted for 54 percent of the entire sample. I received only seven raw data sets. A further seven responses could be labeled as "willing to cooperate." My success rate was 30 percent of the total sample. It is remarkably close to the results presented by Wolins

in 1962 and subsequently by Wicherts et al. in 2006.

I wrote a commentary article about my study and submitted it to *American Psychologist*, where discussion of this particular topic started over half a century ago. To my disbelief, I was told that this particular subject has actually been completely explored and further discussions from now on will be closed: "As you know, every member of APA receives *American Psychologist*. The limited space we have available constrains us, and we can accept only articles that are of interest to a broad range of psychologists and that have broad consequences for the science and practice of psychology. . . . The *American Psychologist* has recently published a comment on this topic, and the present proposed comment does not really add any new additional information to the discussion" (Witkowski and Zatonski 2015).

In the light of such explanations, it is not surprising that Gert Storms has been forced to resign after his refusal to review papers without raw data. How does one dare to reopen an issue already resolved once and for all? Fortunately, Storms is not alone. The idea, called the Peer Reviewers' Openness Initiative, was launched by psychologists hoping to increase transparency in the field of psychology, so often shocked by scientific controversies and scandals. On the other side there are representatives of the APA acting in accordance with previously established rules and laws but not necessarily in accordance with scientific ethics. In this game, the stakes are high: truth and transparency.

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Psychologist and writer Tomasz Witkowski is author of *Psychology Led Astray* and coauthor of *Psychology Gone Wrong*. He is the founder of the Polish Skeptics Club and specializes in debunking pseudoscience, particularly in the field of psychology and psychotherapy.

Burzynski Sanctioned by Texas Medical Board

Robert Blaskiewicz

On March 3, 2017, the Texas Medical Board sanctioned Houston internist Stanislaw Burzynski for over a hundred violations related to his cancer clinic. However, despite these sanctions, Burzynski will be allowed to keep his medical license and continue to practice on patients.

For decades, Burzynski has peddled a chemotherapy he calls "antineoplastons" (ANP) under the auspices of dubious FDA-sanctioned clinical trials (see "Stanislaw Burzynski: Four Decades of an Unproven Cancer Cure" and "Skeptic Activists Fighting for Burzynski Cancer Patients," SI March/April 2014).

Burzynski sells a chemotherapy of the metabolic derivatives of sodium phenylbutyrate, a urea cycle drug that he also produces at his Houston manufacturing facility. Antineoplastons are typically administered intravenously under clinical trial protocols and frequently under compassionate care exemptions. In recent years, however, Burzynski has taken to selling something he calls "personalized gene targeted therapy," which is a low-dose chemotherapy cocktail (based on a genetic test) plus sodium phenylbutyrate. The theory behind antineoplaston therapy, according to Burzynski, is that cancer patients have lower levels of these peptides and amino acids in their blood and urine and that replacing them can cure cancer.

This posits both a cause of cancer that no other researcher has identified and an immune mechanism that remains undescribed in the literature. The "personalized gene-targeted therapy" remains unproven and carries the risk of synergistic toxicities. Merely starting these therapies costs patients tens of thousands of dollars, and there is a hefty monthly fee for as long as the patients are treated. Frequently, patients try to raise hundreds of thousands of dollars for Burzynski online because insurance companies generally do not cover his unproven treatments.

Late in 2013, the Texas Medical Board initiated proceedings against Burzynski. The original slate of charges grew to an amended complaint in the summer of 2014 of over 200 pages of accusations related to ethics, standard of care, and billing procedures, and dozens of patients were mentioned. Following discovery and depositions, a hearing on the merits was convened in front of Administrative Law Judges (ALJs) Catherine Egan and Roy Scudday in November 2015. The hearing was scheduled to take place on either side of the Christmas holiday, with the Medical Board's witnesses' depositions cross-examined first. Burzynski's witnesses had to wait until the spring because Burzynski had a heart attack over the holiday and required

rehabilitation.

In the proposed decision, the ALJs commented on the complexity of the Burzynski proceedings, which covered the treatment of thirty patients over the course of thirteen years. The Board had submitted medical records from all of those patients, as well as thirty-six depositions in fifty-nine volumes totaling 19,870 pages of exhibits. The first draft of the findings was 221 pages long, three times as long as the Board staff's closing arguments, which was limited by the judges to a seventy-five-page brief.

In the end, the judges found that the Medical Board was unable to demonstrate that Burzynski had committed most of the charges they had brought against him, including all of the charges related to the standard of care. The judges explained in their proposed findings:

> [Medical Board] Staff relied heavily on the testimony of three experts, one on ethics, one on billing issues, and another regarding the standard of care. . . . It is important to know that Staff's experts had not seen all the relevant records of the patients upon which they were asked to give an opinion. For example, Cynthia Wetmore, M.D., a pediatric oncologist, testified that [Burzynski] had misrepresented Patient D's tumor response to ANP, when Patient D was not treated at the Clinic. Staff's reliance on the testimony of these experts cast doubt on the validity of its allegations.

While the testimony of these experts may have been put in doubt, the judges at the State Office of Administrative Hearings, which oversees legal proceedings for Texas state agencies and licensing boards, apparently ventured beyond the scope of their expertise and unbelievably released findings of fact regarding the efficacy of Burzynski's treatment, which the Board Staff stressed was not at issue in the hearings. At times, their language parroted alternative medicine talking points:

> Many [of Burzynski's] patients elected to participate in the FDA-approved clinical studies, and others chose to participate in "personalized medicine" treatment that targeted the cause of the cancer rather than the location of that cancer. Because of Dr. Burzynski's treatments, several terminally ill patients recovered. . . .
>
> The alternative therapy provided by Dr. Burzynski during the period at issue has become more accepted and mainstream. During the hearing, Staff took the position that the applicable standard of care regarding Dr. Burzynski's treatments was what was in effect at the time he provided the treatment, even if that treatment protocol has since become accepted in the medical community. Such an approach as taken by Staff would appear to discourage innovation in the treatment of advanced cancers.

Here the judges are not talking about antineoplastons, since that is manufactured and administered by Burzynski alone. Rather they are referring to the use of genetic testing to guide cocktails of chemotherapies. In Burzynski's case, however, he apparently always adds sodium phenylbutyrate. Because that component of the treatment is unique to Burzynski, his personalized gene-targeted therapy simply can't be mainstream or "more widely accepted." Given that there is no theory or mechanism behind why sodium phenylbutyrate or its metabolic derivatives *should* work if they are included in a chemo cocktail, it's not clear how the judges could even justify it as part of off-label innovation.

Even though Burzynski was ultimately found to be sanctionable for more than 130 violations, and even though the Board attorneys recommended revoking his license and then staying that revocation, as a sort of last chance the Board decided to merely stay a suspension and issue a reduced fine of totaling $60,000—$300,000 less than the lawyers had recommended. He will also be saddled with a Board-appointed monitor to ensure that he is following the Board's ruling. According to a press release from the Medical Board, reported in the *American-Statesman:*

> The violations as detailed in the order, and supported by the judges' findings, show a pattern of misleading patients at the Burzynski Clinic. These misrepresentations can lead to direct harm to the public if left unchecked. In total there were over 130 violations cited.
>
> Among the violations are numerous instances of misrepresenting services billed; failing to supervise and allowing those working in his clinic to misrepresent themselves to patients; and a continued failure of not informing patients of potential risks before and during treatment.
>
> The administrative sanctions and penalty levied by the Board as part of Dr. Burzynski's order are in line with the disciplinary sanction guidelines set out in Board rules. Through the probationary terms of this order, Dr. Burzynski is required to make the necessary changes to his practice to ensure the health and safety of all patients seeking treatment at his clinic.

Considering the infamy of the Burzynski Clinic and its impressive history of patient exploitation, many critics—and a large segment of the cancer community—are angered by the outcome. Nonetheless, Burzynski has had his day in court, was given due process, and still failed to convince a demonstrably gullible pair of judges that he was innocent of over 130 violations. In addition to monetary sanctions, he will be forced to take classes in billing and ethics and to have a Board-appointed monitor for the foreseeable future to make sure that he does not continue misleading patients at the Burzynski Clinic. All considered, then, the prospects for patients are therefore marginally improved, and the ruling should therefore be considered a small, unsatisfying victory for public health.

Robert Blaskiewicz is assistant professor of Critical Thinking and First Year Studies at Stockton University, where he specializes in and teaches about science and pseudoscience, extraordinary/paranormal claims, and conspiracy theory. He has followed the Burzynski case for years.

Hans Rosling Brought Data to Life, Showed Our Misconceptions about the World

Amardeo Sarma

Many skeptics outside Sweden first encountered Professor Hans Rosling at the European Skeptics Congress 2013 in Stockholm. That was a day engraved in our memories. Rosling had enthralled us with his fascinating presentation of the world's data. How wrong we were about so many things that we believed about the world. Years earlier, in 2006, Rosling had received the "Enlightener of the Year" award by the Swedish Skeptics Association Vetenskap och Folkbildning (VoF).

It fills us with deep sadness that Hans Rosling died of pancreatic cancer February 7, 2017, at the age of only sixty-eight. He was a professor of international health at Sweden's Karolinska Institute who liked to call himself an "edutainer."

Hans Rosling was able to bring data to life. His project gapminder.org, named for minding the gap between statistics and their interpretation, uses animated graphics to show us how the world has developed and grown since industrialization. Again and again, he shows us how we are wrong in many of our beliefs and that we just don't know much about the world. We are particularly wrong, because of our prejudices, when it comes to what we think about the "third world."

In the "Bangladesh Miracle," he demonstrated how the fertility of women decreased from almost seven children per woman to less than three in just thirty years. It is currently at 2.19. He also shows us how wrong we are for blaming religion and "Islam" for high fertility rates. Poverty, high mortality rates, and lack of education and access to family planning for women—not religion—is why fertility rates remain high in many African countries.

Hans also put facts at the center of the current discussion around refugees. In his video "Where Are the Syrian Refugees?" (https://www.youtube.com/watch?v=0_QrIapiNOw), he rightfully criticized the European Union for doing everything it can to prevent Syrian refugees from exercising their right to asylum. While the rich EU takes only 2 percent of the refugees, Lebanon, Jordan, and Turkey carry 40 percent of this burden. Syria itself takes the rest as internal refugees. Such a situation was completely unacceptable to him.

We have lost someone who motivated us and gave us hope.

As a global citizen, Rosling interrupted his regular work to go to Liberia to help the West African country fight Ebola. "I'm not a virologist, and I'm not a clinician," he said, "but I have considerable experience investigating messy epidemics in poor parts of Africa." Rosling had already played a key role in 1981 in identifying an illness outbreak as konzo. It turned out that the disease was not infectious. Rather, eating raw or insufficiently processed cassava had led to poisoning and the observed paralysis of the limbs of women and children.

My favorite of his legendary videos was the one on the "Magic Washing Machine" (https://www.ted.com/talks/hans_rosling_and_the_magic_washing_machine). He saw this invention as something that liberated women from their tedious manual work of the past. Along with his mother, Rosling concluded: "Thank you, industrialization. Thank you, steel mill. Thank you, power station. And thank you, chemical processing industry that gave us time to read books."

Hans Rosling was a realist whose assessment was based on data. In "Don't Panic—End Poverty," he showed how the goal of the UN to eradicate absolute poverty was not only achievable but that we are well on course to do so.

For most of us, his untimely death caught us completely by surprise. We have lost someone who motivated us and gave us hope. The skeptical movement revered him. Hans Rosling's legacy will remain. His son, Ola Rosling, and his daughter-in-law, Anna Rosling Rönnlund, have promised to continue his mission. They write: "Hans is no longer alive, but he will always be with us and his dream of a fact-based worldview, we will never let die!"

Hans, you can be sure that skeptics all over the world will do all they can to make your dream of a fact-oriented world come true.

Amardeo Sarma is founder of the German skeptics group GWUP and a fellow and member of the Executive Council of the Committee for Skeptical Inquiry.

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Humanities, Too: In New Study, History Courses in Critical Thinking Reduce Pseudoscientific Beliefs

Kendrick Frazier

We often think of the need for critical thinking in the context of nonscientific approaches to extraordinary claims about the natural world. We call that pseudoscience, and as an antidote we often prescribe more science courses, especially those focusing on skeptical thinking. But critical thinking is not unique to the sciences.

A study by two researchers at North Carolina State University, Anne McLaughlin and Alicia McGill, indicates that explicitly teaching critical thinking skills in a humanities course can significantly reduce students' beliefs in pseudoscience, pseudo-archaeology, and pseudo-history.

They worked with 117 students in three different classes. Fifty-nine students were in a psychology research methods class that did not specifically address critical thinking. They served as the control group. The other fifty-eight were in one of two courses on historical frauds and mysteries. Their courses were explicitly designed to cultivate skills in critical thinking. Among the course materials were Kenneth Feder's *Fraud's, Myths, and Mysteries* and Carl Sagan's "baloney detection kit." More than a dozen pseudoscientific ideas were critiqued, including Atlantis, the Piltdown hoax, and the belief that the Egyptians had to have been aided by "ancient aliens" to build the pyramids.

Before and after the course, students in all three courses took a baseline assessment of their beliefs in pseudoscientific claims on a scale of 1 ("I don't believe at all") to 7 ("I strongly believe"). The control group students did not change their beliefs, but students in both history courses had lower beliefs in pseudoscience at the end of the semester.

One of the history courses was for honor students, and those students decreased the most in their pseudoscientific beliefs, an entire point for beliefs

covered in the class and 0.5 points on topics not covered.

Even beliefs in specific topics not covered in the history courses went down, an indication that students were applying their critical thinking skills on their own.

"The change we see in these students is important, because beliefs are notoriously hard to change," said McLaughlin, associate professor of psychology at NC State.

Coauthor McGill, assistant professor of history at NC State, agrees. "This drives home the importance of teaching critical thinking and the essential role that humanities can play in the process," she was quoted as saying in a university news release. She said the study may be especially timely right now. "Humanities courses give students tools they can use to assess qualitative data and sort through political rhetoric," she says. "Humanities also offer us historical and cultural perspective that allow us to put current events in context."

Their study, "Explicitly Teaching Critical Thinking Skills in a History Course," was published in the March 20 issue of *Science & Education*.

It seems to be having some impact already. McLaughlin told the Skeptical Inquirer that they have received many emails from the media and other professors eager to learn what techniques can help students learn critical thinking skills. "It's very heartening. People seem hungry for critical thinking tools and often somewhat surprised that students probably won't just pick up those skills without explicit instruction and practice."

Their study couldn't track students over time, but McLaughlin told SI she plans to incorporate some similar critical thinking activities into her courses starting this fall and get approval to follow those students over a longer time.

This is just one small study of students at one university, so it is probably best not to make too much of it. If the effects of the humanities courses' successful teaching of critical thinking skills could be shown to persist over time, it would be an especially welcome advance. In the meantime, it is good for all of us to recognize that science courses aren't the only academic route to teaching critical thinking and resisting pseudoscientific ideas.

Kendrick Frazier is editor of the Skeptical Inquirer.

[INVESTIGATIVE FILES JOE NICKELL

Joe Nickell, a former magician and private detective, did graduate studies in English (folklore, linguistics, criticism, etc.), culminating in his doctoral dissertation, *Literary Investigation* (1987). Since 1995, he has been CSI's senior research fellow, examining fringe-science claims.

Murder by Darkness: Does Mammoth Cave's Specter Harbor a Secret?

If reported encounters are to be believed, Kentucky's Mammoth Cave—the longest cave system in the world—holds an almost-lost secret. Supposedly revealed "to those who have witnessed her spirit" ("Ghost Stories" 2016), a murderer's ghost haunts the cave's winding passageways—especially "the area known as Echo River" (Hauck 1996, 188).

The Dark Side

To understand the following ghost story, it is important to appreciate what it's like to be in the deep recesses of any great cavern such as Mammoth Cave and have the lights turned off. The result is darkness so absolute it impresses all who have experienced it. I can attest to this not only in Mammoth and Carter caves of Kentucky but also in Carlsbad Caverns of New Mexico and many other commercial caves where this brief entertainment has become a mainstay of tours.

It once happened to me accidentally in southern Kentucky's Sloans Valley Cave System—a "wild" (i.e., noncommercial) cave I often explored with fellow spelunkers during my undergraduate years of university. I was climbing down a well-like shaft when the carbide lamp mounted on my hard hat suddenly went out. By then an experienced cave explorer, I knew what to do and did it—without panic. (I stuck a penlight in my mouth and, nestling into the rock wall, proceeded to ream out the lamp's brass tip and—I'm leaving out a few steps here—restored the light [Nickell 2016].)

I mention all this to prompt readers to imagine what it would be like to be left alone deep in a cave's profound, deadly dark. Reportedly, that was the means of effecting a homicide in the great cavern in 1843, and the killer—who before her own death published a confession—has become a ghost.

'Melissa'

This particular spirit (among a few others alleged to haunt the cave) is known only as Melissa—a young woman whose love for her tutor was not reciprocated. She sought revenge and found an opportunity to abandon him in the cave without a lamp. He was never seen again.

"Some say" that Melissa's ghost still searches for his. "Rangers have reportedly heard a woman's voice calling from deep within the cave's labyrinthine passageways, as well as screams and garbled voices" ("Is Kentucky's" 2012). However, a more experienced source insists that most of the park rangers tend to laugh away the ghost tales ("Haunted" 2016).

But again, "some say" Melissa contracted consumption. "So it is that to this day," asserts raconteur Christopher K. Coleman (2011, 81), "visitors may still hear Melissa calling out for her lost love, her doleful refrain and her coughing telltale signs that her restless spirit roams the caverns still." Yet again, "Others report hearing a woman whispering or weeping in the cave that they believe to be Melissa's ghost" ("Mammoth Cave" 2016).

But how can Melissa's ghost do any of these things—if Melissa herself never existed? Certainly, she cannot be proved real. Neither can any record be found of her tutor, said to have been a "William Beverleigh"—or indeed of anyone else who disappeared in Mammoth Cave during the 1840s period ("Mammoth Cave" 2016). And yet I did refer to the alleged female killer's published "confession."

Truth Unveiled

Melissa's story, "A Tragedy of the Mammoth Cave" appeared in *The Knickerbocker* in February 1858. Its having been published anonymously enhanced the believability of what purported to be a woman's first-person admission of murder. She begins:

> For fifteen long years I have carried a dark secret buried in my heart, until it has worn away my life; but now that I am tottering on the brink of the grave, I am impelled to make a confession, which, tardy as it is, I hope may render more tranquil my last sad hours. The tenacious care with which I have ever guarded the knowledge of my crime is no longer necessary, for no injury can now be wrought by a disclosure which, if earlier made, would have held up my name to eternal infamy as the blackest of my sex, and brought disgrace on one of the proudest families in the land. (Blake 1858)

She goes on to tell—at some length—the story sketched earlier. Ending her narrative, she resolves:

> I am going to reenter that dark Cave, the threshold of which I have not crossed for fifteen years, and there I will patiently await the coming of that death, which I hope to me will be a blessed release. The gloom and horror to which, years ago, I doomed

> my victim, shall be around me when I die: for I think that perhaps from amid the silent rocks which witnessed my crime, my last prayer for forgiveness will find acceptance. (Blake 1858)

Sophisticated readers of *The Knickerbocker* narrative will recognize the anonymous confession as an obvious work of fiction. It is written at a high level of vocabulary and sentence structure. (Application of a standard readability scale [Bovee and Thill 1989] shows the writing to be at today's college senior level.[1]) It is replete with poetic phrases ("Tottering on the brink of the grave," and so on [Blake 1858, 111]), and it offers sophisticated philosophical musings: "Perhaps some of the most wholesome lessons I had ever yet learned were in the wonder and awe and knowledge of my own insignificance, which I felt in contemplating those sublime arches and mysterious caverns" (Blake 1858, 113).

Its form is *narrative* with *plot*, in this case one that begins with a situation, shifts back in time to launch the story, and, continuing apace, transforms the chronology into a causal arrangement—finally returning to the beginning situation. It uses such devices as *characterization*, *description*, *foreshadowing*, *suspense*, and *verisimilitude*.[2]

In fact, it was created by fiction writer Lillie Devereux Blake (1833–1913) who penned the fanciful piece after she and her husband Frank Umsted (whom she married in 1855) visited Mammoth Cave, traveling by train, steamer, and stagecoach (Farrell 2002, 40, 44–46).

Phenomena Explained

But if Melissa was unreal—and so likewise her surviving spirit—then how is it that people nevertheless report encountering her? Unfortunately, most such claims, along with reports of other ghosts—like that of famed cave explorer Floyd Collins, who in 1925 was trapped in nearby Sand Cave for fourteen days until he died pitiably—come to us without source or documentation. The few apparitions may be attributed to shadows from flickering lamps or spectral images that well up from the subconscious and are superimposed on the visual scene (Nickell 2012, 345). Some incidents may be made up.

Still there are frequent reports of "weird noises" that "are usually attributed to" Melissa's ghost. What are we to make of the previously mentioned whisperings and weepings and other sounds, even "the plaintive sound of a woman calling out, as if she is searching for someone" (Coleman 2011, 80)? Can multiple ear-witnesses be mistaken?

The fact is, hearing such expressions is common to being in caverns, as most spelunkers soon learn. Many have played the game of sitting in the dark and listening to water dripping, trickling, and murmuring. In such random background noise, we may perceive the sounds of people talking, whispering, crying, or the like. The effect is due to the neurological-psychological phenomenon known as "pareidolia," by which the brain interprets vague images or sounds as specific ones—such as seeing pictures in clouds, finding Jesus's face in the skillet burns on a tortilla, or hearing spoken spirit words or phrases in a ghost hunter's recorded white noise (Nickell 2012, 351; Novella 2009).

Lessons Learned

Lillie Devereux Blake did not create the ghost of Melissa, which is not part of her narrative. However, she unwittingly provided the seeds of that very creation. At the end of her tale, when she has the murderess say that, since her crime, "I have been a constant wanderer in search of health and happiness, always in vain," Blake helped spark the idea of Melissa's ghost's eternal wandering. And when the author has Melissa state, "I shall have buried myself in a living tomb," she has helped set the stage for a perpetually grieving, searching spirit.

Credulous believers in ghosts—unable to discern that "Melissa's" story was fiction—were quick to find, in her apparent confession, confirmation of their superstitious beliefs. They have therefore told and retold the story, thus creating differing versions, what folklorists call "variants." (In one, for instance, after Melissa left Beverleigh to his doom she allegedly "went back to find him" ["Mammoth Cave Ghosts" 2016]—an act which never occurred in the original [Blake 1858]. Again, although in the original story in *The Knickerbocker* the murderess says only that she is dying of a "deadly disease" [Blake 1858, 121], some later writers assert she "died of tuberculosis"—hence her ghost's reported cough [O'Malley and Sawyer 2014, 175–176].) Ironically, an allegedly "true" folktale has thus been created out of pure fiction.

For the rest of us, Blake has also created—no doubt again unintentionally—a cautionary tale about critical thinking. It might begin, "Once upon a time, there was a story that—on reflection—might've seemed too good to be true. . . ." ■

Notes

1. This was applied to the first paragraph of the text (a 114-word sample—Blake 1858, 111).
2. See Holman (1980), s.v. the italicized terms.

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[A MAGICIAN IN THE LAB JAMES RANDI

James Randi began his career as a stage magician and escape artist but achieved fame as a professional skeptic, disproving the claims of self-described psychics, mind readers, and faith healers. He is a founder of the Committee for Skeptical Inquiry (formerly CSICOP).

The Farce Known as 'FC'

I must address you about what's known as "facilitated communication," which involves what's now most often called "autism spectrum disorder" (ASD), a subject that deeply concerns me. The first-ever fully identified and defined example of autism was only found in 1941.

This facilitated communication (FC) is simply a blatant stunt claimed to be a means of communicating with autistic children and adults afflicted by this complex neurological condition. ASD victims show widely varying degrees of impaired social interaction and communication—typically avoidance of eye-contact and strangely restricted and compulsively repetitive behavior. These symptoms first show up before a child is three years old and can become much stronger and more dangerous to that person's well-being, though many mature into adulthood and survive—though with difficulty. The U.S. Centers for Disease Control and Prevention estimates that one in forty-five persons in this country can be said to have at least some degree of autism—this is a figure that demands the very serious attention of the skeptical community!

Different authorities and quite unqualified celebrity figures have argued variously that the mercury compounds once used as preservatives in some vaccines trigger it—specifically the measles-mumps-rubella (MMR) vaccine—a notion now completely disproven but still embraced by some.

In March 1992, I was contacted by Dr. Anne M. Donnellan—then with the University of Wisconsin–Madison—who told me about a situation in which she was deeply involved. What little I already knew about FC indicated to me that she was very, very, misdirected and self-deceived.

The seemingly meaningful messages do not come from the child....

I told her that the security of the children involved in this research must have priority and stated that if I became part of the investigation, that would have to be the primary consideration. I also said that I would gladly participate without any remuneration other than my basic costs of travel and accommodation.

She explained to me the difficulty of communication with the autistic children due to *apraxia*—the inability to perform simple, coordinated, physical actions even though the muscular ability is present. She told me that facilitated communication consists of the "facilitator" (an adult clinician or scientist) being *in physical contact* with the child while the child has access to an "augmentative device" (computer keyboard, typewriter, alphabet blocks, letter chart, etc.), which the child would be unable to manipulate sufficiently well to communicate. She said that certain children had shown remarkable abilities under FC, expressing ideas and concepts that had formerly been believed to be far beyond their abilities.

I told her that I felt the researchers might be under the influence of the Clever Hans Effect, in which the "facilitator," in this case, might be—unknowingly—transmitting the sought-after responses to the child. This suggestion was emphatically denied, and I was told that every care had been taken to ensure that this was not possible. Her enthusiasm for this point was quite contagious, but I was immune to such an infection.

I'd already seen several videos of the facilitated communication procedure being used on autistic kids. The adult

"facilitator" grasps the hand of the child, with the child's index finger extended out over the keyboard of the computer. In almost every case, the child is looking away, uninvolved in the procedure, often babbling or screaming as the facilitator studies the keyboard and *uses the subject's finger as the tool with which he or she is typing*! It is abundantly obvious that the child is *not* typing. No, the "facilitator" is typing, using that child's finger!

However, another reported phenomenon was reported to me. Particularly in view of my own expertise, I was told that several of these children claimed that they were able to "read minds." This was the primary reason that I had been contacted, it turned out, due to my extensive involvement in such investigations.

The autistics were able, I was told, to thereby communicate with one another, the main reason for Dr. Donnellan having asked me to visit and to advise the group, since as a result of my expertise as a magician I should be able to determine whether telepathy might be in operation. I went to Madison fully aware of what was happening there before I took on the task.

I agreed to participate in an investigation of both these situations, though—please note—I was regularly being encouraged *not* to examine the basic facilitated communication claim itself, but I'd already seen it in operation, and I doubted its efficacy. I was assured that all "that" had been firmly established. This task required that I visit Madison to observe the children in person. Believing that I could be of use to the project, I agreed.

Dr. Douglas Biklen of the University of Syracuse has promoted the FC procedure as valid, quite in error in my opinion. You may have seen the very definitive, powerful, video prepared and broadcast by PBS, *very* damning evidence against FC. In this documentary, the autistic subjects are looking away, quite unaware and disinterested in what is being asked of them. The fact that the *supporters* of the FC notion also saw this proves that they are ignoring the very strong evidence that the data originates with the "facilitator." It does not come from the child at all. FC is not communication. It is blatant manipulation.

Dr. Biklen founded his university's Facilitated Communication Institute in 1992. In August 2005, he was promoted to Dean of its School of Education, from which he retired in 2014, and this appointment was strongly criticized by the Commission for Scientific Medicine and Mental Health and by members of the Special Education research community. In 2012, Biklen received a United Nations prize that was awarded him because of his advocacy of FC, which—again—had been so very, very, thoroughly and effectively debunked as wishful thinking, bad science, and nonsense on the 1993 television special on PBS *Frontline* as well as through my personal investigation and experience with this manipulative deception the year before in 1992.

The MIT Media Lab endorsement of the facilitated communication farce is very discouraging and alarming to me.

But please, you must remember the financial investment that Syracuse University still has in FC, via Dr. Biklen. It brings in millions annually from desperate parents and charities.

Dr. James T. Todd invited me to speak at Eastern Michigan University in 2005, and as a result he issued a direct challenge to the Autism Society over its sponsorship of a facilitated communication training workshop. Two of the attendees at that workshop, the Wendrows, were falsely accused—via facilitated communication—of rape of a child. They were arrested and jailed.

But I must wonder whether the Wendrows' naive acceptance of FC and their previous vigorous denunciation of me remained in effect after they themselves experienced—*firsthand*—the damage that it can wreak. The Wendrows sued and got a $1.85 million settlement from the police. This situation was covered in a six-day front page story in the *Detroit Free Press* and on an ABC-TV *20/20* show.

As chief supporters of FC at the University of Syracuse and the force behind getting the MIT Media Lab to host Dr. Douglas Biklen's annual Facilitated Communication "Summer Institute," those communication experts and scientists at the MIT Media Lab ought to have been the first to reject FC. I've spoken there, several times, but it appears that some of its staff are true believers in FC, and some are significantly beholden to certain supporters of FC for financial support.

The MIT Media Lab endorsement of the facilitated communication farce is very discouraging and alarming to me. I just cannot understand how such a splendid facility can give approval to this dangerous—and useless—procedure. I always stood ready to design and conduct comprehensive tests of FC, and I still do, but apparently the money interests have been more successful, having spoken louder than rationality.

And—in closing—I will tell you that in my early correspondence with Dr. Donnellan I learned that one of the autistic children she said I would be meeting in Madison, six-year-old "Andrew," had been banging his head on the floor, which is a not-uncommon practice of autistic children at the far end of the spectrum, and when the child got in front of the keyboard and was asked why he did the head-banging, he answered—by "assisted" typing, remember!—that his head hurt. Asked why his head hurt, he typed out—correctly spelled, they claim—"Because you need to operate on my hypothalamus." This from a six-year-old child? And correctly spelled? Do these scientists actually believe this report?

Apparently, they do!

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The Monster of Florence: Case Closed?

The Terrifying Story of the Most Infamous Ritual Murders in Italian History, Part 1

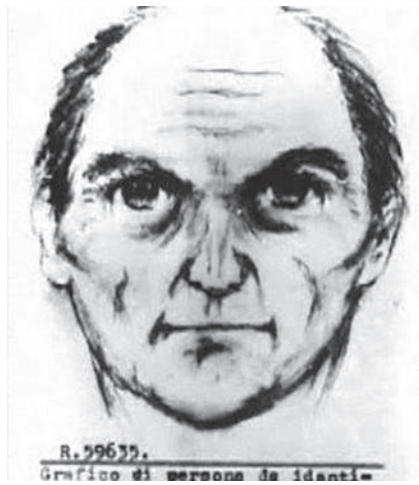
Fernando Pucci recently died at age eighty-six. He was the last of the serial killers collectively known as the "Mostro di Firenze," the Monster of Florence, or "i compagni di merende," the "picknicking friends," as they started to be called during trials after one of the convicted killers, Mario Vanni, described his relationship with the others: "We were just picknicking friends." This is considered one of the most heinous stories of violence in Italian history, and in the 1997 trial of this bizarre case, it was Pucci who placed the murderers at the scene of some of the crimes, helping to condemn them.

So the curtain falls on a story in some ways still obscure: fifty years after the first crime, the figure of the Monster of Florence, a mysterious serial killer who up until 1985 terrorized the Tuscan hills, killing young couples and mutilating their bodies. Perhaps most familiar to American audiences as the subject of a best-selling book by Douglas Preston and Mario Spezi, the case has now entered the collective imagination of Italians.

But is the case really closed? And what of the claims of a mysterious satanic cult that some thought was commissioning the acts of violence to the "picknicking friends"? Let's examine this strange tale from the beginning.

The Monster's Crimes

Fear of the Monster actually came with time: only after several victims were killed did the idea of an alleged serial killer start to circulate. The first murders connected to the Monster of Florence date back to August 21, 1968, when in a white Giulietta car, in Castelletti Signa, Barbara Locci and her lover, Antonio Lo Bianco, were killed with eight gunshots from a .22 caliber pistol. For this crime, Stefano Mele, a Sardinian shepherd and Locci's husband, was sentenced with the murder, which was labeled an act of jealousy. Mele had confessed but later retracted the confession.



A forensic sketch of the "Monster of Florence"

Six years went by and on September 14, 1974, in Borgo San Lorenzo, Stefania Pettini and her boyfriend Pasquale Gentilcore were killed inside a blue Fiat 127. The boy was murdered by gunshots using the same weapon that had been fired in 1968. The killer didn't use a gun on the woman but instead stabbed her ninety-six times and violated her with a tree branch.

Seven years passed until the killer returned: between June 6, 1981, and September 8, 1985, six young couples who had gone to the hills around Florence at night were slain. In each case, the boys were killed with .22 caliber bullets fired from the same gun used in 1968. Moreover, almost always the girls' genitals were excised and in a few cases their left breasts were taken. There is only one exception in the type of victims: on September 9, 1983, two Germans, Friedrich Wilhelm Horst Meyer and Uwe Jens Rusch, were shot. The two young men camped in a minibus, but perhaps the killer was misled by the fact that one of them had long blond hair and mistook him for a woman.

Fear of the Monster and a Mysterious 'Doctor'

Years of panic and veritable mass hysteria followed. It was not the first time that Italy had known the brutal work of a serial killer, but it was the first time that a story of this kind reached the national spotlight. Much of the fear and attention was driven by the savagery of the crimes and by the fact that the murderer struck young couples in search of secluded intimacy. The location where the crimes took place—the peaceful and idyllic Tuscan countryside—contributed to making these events all the more inconceivable. And finally, the fact that year after year the threat returned, seemingly unstoppable, spread terror.

At the peak of the panic, the City of Florence distributed warning posters: "Watch Out, Kids" said an inscription above a drawing of a big eye, with a series of warnings in five languages. "You could be attacked. It is advised not to stand alone and in isolated places at night outside urban centers." Among

Tuscan families, many parents preferred to leave home in the evening in order to leave it available for a daughter and her boyfriend rather than let them go out by car for romance and risk them not returning.

Rumors fed by sensationalist news reports began to circulate the idea that the Monster could be a professional with a double life: perhaps a gynecologist, who saves lives during the day and at night turns into a murderous Mr. Hyde. The idea of a physician, in particular, appealed to the newspapers: considering what he did, the murderer must be someone who understands anatomy, they claimed, someone who knows how to use a scalpel. In anonymous letters sent by the dozens to investigators, many well-known surgeons were accused. The rumors, completely unfounded, were invariably picked up and shared by the newspapers, with the only result being reputations tainted by the slanderous accusations. The Prosecutor of the Republic, Enzo Fileno Carabba, was forced to issue a statement in which he "denies the validity of the news reports, in relation to rumors circulating in Florence and its surroundings relating the arrest or investigation of people suspected of the crimes in question…. At present no particular person is suspected or apt to be suspected of the murders."

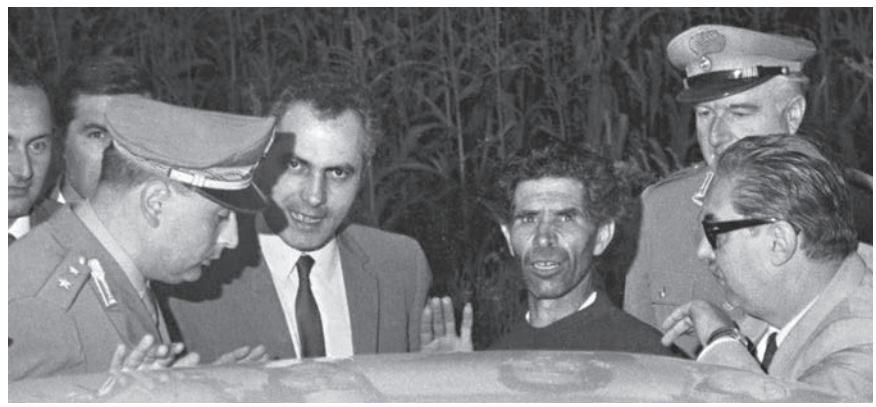
The obsession that led people to see the Monster everywhere eventually had tragic results. After the murders of 1982 in Calenzano, the police circulated a depiction of a wild-eyed man, seen by some witnesses driving a car away from the murder scene. He is a broad-faced man, balding, with large eyes, which inevitably looks like many people. After the trial it would appear to have a striking resemblance to Pucci himself. At the time, however, the depiction resembled among many others a man named Giuseppe Filippi, the manager of the restaurant Il Cavallino Rosso in Valenzatico near Pistoia. The victim of cruel jokes, Filippi was often called "the Monster." Indeed, groups of people went to his restaurant just to catch a glimpse of him. On July 3, 1983, tired of the rumors—and the victim of a nervous breakdown—Filippi took his life by cutting his own throat with a knife.

A Complicated Investigation

The investigations pointed in all directions. If for the first crime a "passion" or jealousy motivation was accepted, for the second it was assumed that the killer was a pervert, and a voyeur in the third case. When the world of voyeurs was finally investigated, it turned out that these individuals were well organized and there are so many that they had divided the "interesting" areas in the countryside around Florence. Some places are better than others and so there frequently are exchanges among them: a good position can be worth the report of a "good car," meaning a car owned by couples who go wild, without too many inhibitions and without worrying about being spied on. Some people are voyeurs of voyeurs, watching and photographing the hidden individuals because they may occupy high social positions and, subsequently, can become prey to blackmail and extortion.

But both the perverts' and voyeurs' trails led only into blind alleys on the Monster case. Only with the fourth murders did the investigators realize that the killer was always the same, and thus the varied (and contradictory) motivations previously ascribed to the killer could not all be correct. It was then decided to go back to investigating the first person arrested, Stefano Mele. Mele originally denied the accusations but later confessed and tried to involve other Sardinians, including brothers Francesco and Salvatore Vinci, who were both his wife's lovers. The various versions of Mele's story, however, did not hold up to scrutiny and, in the end, Mele was the only one convicted (and sentenced to fourteen years in prison) for the first murder.

The fact that all the crimes were committed using the same weapon used in 1968 led the investigators to identify Mele as a suspect. However, Mele could not be the monster because he was in prison during two of the attacks, in 1974 and 1981. There were other arrests among the Sardinians, but all of them were eventually freed when the Monster struck while the suspects were in custody. In 1989, the investigating judge Mario Rotella dismissed the "Sardinian leads" and acquitted all those suspects of charges related to the first murders.



Monster of Florence suspect Stefano Mele being arrested.

The police had many difficulties investigating the Monster of Florence crimes, for several reasons including that they were not prepared to deal with serial killer cases and that at the time of the first attacks computers were rare and forensic investigation techniques (such as DNA sequencing) were in their infancy. There was also some lax recordkeeping in the investigations. Many of the shells fired from the Beretta, for example, are now missing, and some important evidence has been lost or improperly analyzed. During the autopsies, nobody thought of keeping tissue samples of the victims, making it impossible to compare it with any human remains that could be found in the possession of the suspects at a later date.

The case had to start again from scratch—almost.

In Part 2, we will see how a tip turned the spotlight on a shady figure that never before had entered the investigation: a farmer from Mercatale Val di Pesa named Pietro Pacciani.

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The March for Science

Partisan Protests Put Public Trust in Scientists at Risk

On April 22, thousands of scientists and their supporters gathered in Washington, D.C., and at more than 600 other locations across the world to participate in the March for Science. Pegged to Earth Day, protesters voiced their opposition to proposed federal cuts to funding for scientific research and the planned rollback of environmental rules and public health regulations. They raised alarm over the appointment of political officials dismissive of climate change and of President Donald J. Trump's false claims about vaccines and global warming.

Previous Democratic administrations have made questionable decisions on science policy, but regardless of where you stand politically, the actions so far of the Trump administration should be deeply disturbing to anyone who cares about the future of the scientific enterprise, much less the planet. Yet it is unlikely that the March for Science will have much of an impact on federal policy over the next few years. Instead, in the long run, the March for Science may have only deepened partisan differences, while jeopardizing trust in the impartiality and credibility of scientists.

Blind to Mistakes

"When you become scientifically literate, I claim, you become an environmentalist," Bill Nye, an honorary cochair of the March for Science told the *Washington Post* (Gibson 2017). Many signs carried by protesters echoed that assumption, emphasizing themes like "Make America Smart Again," "Science is the cure for bullshit," and "Knowing stuff is good."

Another March for Science sign quoted astrophysicist Neil de Grasse Tyson admirably stating that "I dream of a future where the truth is what shapes people's politics, rather than politics shaping what people think is true." Yet as risk communication expert David Ropeik (2017) countered, decades of social science research suggests that human cognition and decisions rarely if ever work in that way.

Humans are not robots. A deficit in science literacy is not why political leaders and the public disagree over climate change, vaccines, or government funding. By fundamentally misdiagnosing the causes of political conflict today, March for Science advocates may be undermining their own cause. Numerous studies show it is often the best educated and most scientifically literate who are prone to biased reasoning and false beliefs about contentious science issues. The reason for this surprising paradox is that individuals with higher science literacy tend to be more adept at recognizing arguments congenial to their partisan identity, are more attuned to what others like them think, are more likely to react to these cues in ideologically consistent ways, and tend to be more personally skilled at offering arguments to support their preexisting positions (National Academies 2017; Nisbet 2016).

For example, studies find that better educated conservatives who score higher on measures of basic science literacy are more likely to doubt the human causes of climate change. Their beliefs about climate science conform to their sense that actions to address climate change would mean more government regulation, which conservatives tend to oppose (Kahan 2015). Similarly, better educated liberals engage in biased processing of expert advice when forming opinions about the risks of natural gas fracking, genetically modified food, and nuclear energy. In this case, liberal fears are rooted in a generalized suspicion of technologies identified with large corporations (Nisbet et al. 2015).

The same relationship holds in relation to support for government funding of science. Liberals and conservatives who score low on science literacy tend to hold equivalent levels of support for science funding. But analysis shows that as science literacy increases, conservatives grow more opposed to funding while liberals grow more supportive, a shift in line with their differing beliefs about the role of government in society (Gauchat 2015).

In sum, our beliefs about contentious science issues reflect who we are socially and politically. The better educated and more literate we are, the more adept we are at recognizing the connection between a political issue and our group identity and interests (Kahan 2015).

Similar factors influence policy decisions. As the late sociologist Dorothy Nelkin (1978) observed nearly forty years ago, political disputes such as those over climate change, vaccination, and scientific funding are fundamentally controversies over political control: Who gets to decide the priority that these issues should take over others, or the actions and costs taken to address problems? Which values, interpretations, groups, and worldviews matter and which should be given greatest weight?

For these reasons, much of the rationale behind the March for Science is not only off target, but the event itself and similar future activities may only intensify political deadlock rather than overcome it.

Staying Credible

Although the March for Science was framed as nonpartisan, the messaging leading up to and during the event was anything but helpful. Early on, reflecting contemporary debates on college campuses, organizers were besieged by concerns over issues related to inclusion and identity. Some criticized the organizers for not paying enough attention to these topics, which prompted the posting online of a diversity statement. In response, cognitive psychologist Steven Pinker tweeted: "Scientists' March on Washington plan compromises its goals with anti-science PC/identity politics/hard-left rhetoric" (Sheridan and Facher 2017).

Twitter remained a source of controversy for organizers. A few days before the event, the official March for Science account declared that the U.S. bombing of an ISIS compound in Afghanistan was an example of how "science is weaponized against marginalized people." The Tweet was later deleted, earning ridicule from right-wing bloggers (Kelly 2017).

On the day of the march, across cities, some participants donned pink "brain caps," a reference to the pink "pussy caps" worn at the January 2017 Women's March. In a similar tribute, T-shirts and signs declared "Keep your tiny hands off my science." Many signs played on the official Hillary Clinton campaign theme "I'm with her," with an arrow pointing to planet Earth instead. Some signs mocked Trump by employing allusions to science, referencing him as an "absolute zero" and "black hole." Other cheeky slogans included "Less invasions, more equations," and "I've seen smarter cabinets at IKEA" (Politi 2017).

In these cases, the March for Science constitutes a potentially hazardous misfire. By choosing public protest as a main strategy, and by voicing messages that have an obvious partisan and ideological slant, the March for Science made it that much easier for Americans to lean on their group identities in forming opinions about contentious issues.

A much discussed recent study published in *Environmental Communication*, a journal where I serve as editor-in-chief, suggests that scientists may have more discretion to advocate on behalf of policy positions than they assumed, without hurting their credibility (Kotcher et al. 2017). Yet the preliminary study did not test what happens to the perceived credibility of scientists when those policy positions are argued in the context of clear partisan messages communicated by way of protests such as the March for Science.

Since the 1970s, public confidence in almost every major institution has plummeted. Yet confidence in the leadership of the scientific community has remained strong (Funk and Kennedy 2017). As a consequence, scientists in society today enjoy almost unrivaled communication capital. The challenge they face following the March for Science is how to use this capital wisely and effectively.

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Can Anything Save Us from Unintended Consequences?

Quick quiz: What caused the Great Recession of 2008?

OK, I admit it. That's an unfair question. It was complicated. If you've done some homework, you might be able to mumble something about a housing bubble, subprime lending, mortgage-backed securities, credit-default swaps, big banks, irresponsible borrowers, George W. Bush, Barack Obama….

But there is one thing I can be fairly certain you will not mention: the Bankruptcy Abuse Prevention and Consumer Protection Act of 2005 (BAPCPA). You may not have heard of BAPCPA or, if you have, it may only be a foggy memory. So, here is a little history:

In the 1990s, personal bankruptcies were rising sharply, and the banking industry began a lobbying campaign to stiffen the bankruptcy requirements—a move that was expected to increase the profits of credit card companies. Attempts to pass a bill failed until President George W. Bush was reelected in 2004. Finally, after big banks spent $40 million in campaign contributions and millions more in lobbying efforts, the bill went into effect in late 2005 (Labaton 2005). It had a number of provisions, but most importantly it increased the up-front costs of filing for bankruptcy and made the process more onerous.

Of course, people should pay their bills. We all should live up to our responsibilities. But, as President Obama was fond of saying, America is a nation of second chances (Obama 2016). Bankruptcy is designed to give people a "fresh start," a chance to right their financial ships. Furthermore, it often works as intended. While writing a book about the psychology of spending and debt, I met a number of people who went through bankruptcy and were able to get their lives back on course. However, the money written off in bankruptcy cuts into the profits of credit card companies and other lenders and keeps interest rates high; so the banks lobbied to make the bankruptcy requirements more difficult. Little did they know what would happen next.

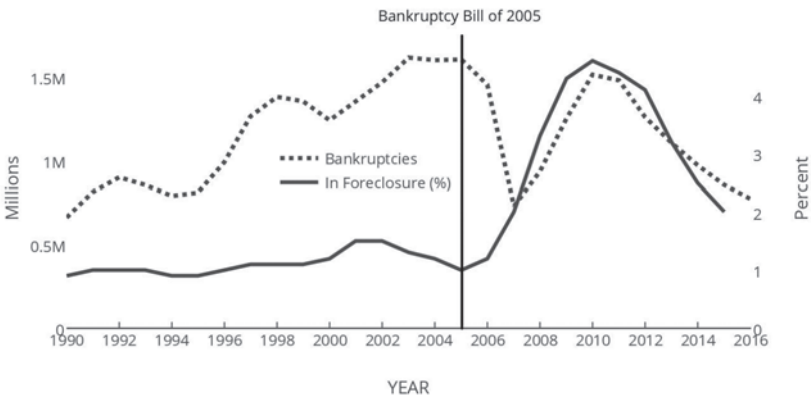


Figure 1. Nonbusiness (personal) bankruptcies and percentage of homes in foreclosure (right-hand axis) for the years 1990–2016. The vertical line marks the implementation of the Bankruptcy Abuse Prevention and Consumer Protection Act of 2005. Sources: U.S. Courts and Mortgage Bankers Association.

Although it took a few years to figure out, several economic studies now conclude that the BAPCPA was a precipitating factor in the ensuing debacle of 2008 (Albanesi and Nosal 2016; Li et al. 2011; Morgan et al. 2012). According to these investigations, once the new bankruptcy requirements went into effect, many people who were struggling with debt found bankruptcy was no longer an option. Ironically, they could no longer afford to declare bankruptcy. But what remained an option was not paying the bills, and beginning in 2007, a little over a year after BAPCPA went into effect, an increasing number of homeowners chose to stop paying the biggest bill of all—the mortgage. The switch from bankruptcies to foreclosures can be seen in Figure 1.

The rest is history. Many of those mortgages had been bundled together and sold to investors, and when the value of those mortgage-backed securities started to tank, so did the stock market, the employment rate, and the economy in general. Obviously there are many other factors that went into

the Great Recession. BAPCPA was not the only cause. But the crash of 2008 started when the real estate bubble finally burst in 2007, and the bursting of the bubble gained steam when thousands of homeowners stopped paying their mortgages. Had bankruptcy still been an option, some of those people might have been in a position to keep paying the mortgage.

The beauty of bankruptcy as a form of financial failure is that most of the effects are restricted to the individual filers and the banks. Foreclosure is a different matter entirely. When your neighbor forecloses, your house loses value, and the real estate market and the economy in general are affected. As President George W. Bush explained when he spoke to the nation in September of 2008:

> Borrowers with adjustable-rate mortgages, who had been planning to sell or refinance their homes at a higher price, were stuck with homes worth less than expected, along with mortgage payments they could not afford.
>
> As a result, many mortgage-holders began to default. These widespread defaults had effects far beyond the housing market. (Bush 2008)

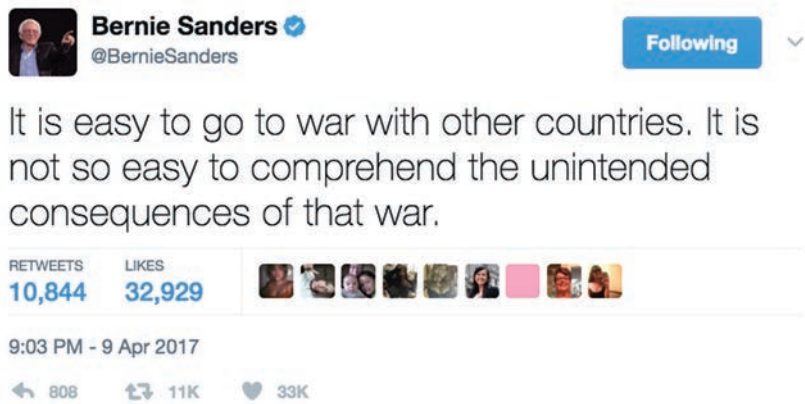
So, in what would be a colossal case of unintended consequences, bankers hoping to save money may have fueled the biggest banking crisis since the Great Depression. It has been estimated that U.S. banks lost $550 billion in the 2008 recession (Boswell 2013), and homeowners, consumers, and workers lost much more.

Unintended Consequences

The history of economic and government intervention has produced many examples of unwanted consequences. Most of us can think of a military campaign that was heralded at the beginning but was later described as a quagmire. One of my favorite cases from behavioral economics is a study of daycare centers in Israel that introduced a fine for parents who were late picking up their children (Gneezy and Rustichini 2000). Once the policy was introduced, late pickups nearly doubled. Apparently parents thought of the fee not as a fine but as the cost of purchasing lateness. As a result, they felt more justified in being late than when the only consequence was the ire of the daycare staff.

Good, Bad, and Perverse Outcomes

The Israel daycare study produced what is sometimes called a "perverse effect": making the problem it was designed to fix even worse. We also should acknowledge that sometimes unintended consequences are positive. For example, the drug that was eventually marketed as Viagra was originally developed to treat angina. Its more lucrative application was an unanticipated "side effect" discovered during clinical trials (Jay 2010). Many "off-label" uses of drugs begin with the discovery of unanticipated side benefits.



An unexpected benefit is a happy surprise, but for a couple of reasons we are more concerned about negative consequences. First, as the work of psychologists Daniel Kahneman and Amos Tversky demonstrates, losses hurt more than gains feel good (Kahneman 2011). Unexpectedly losing $100 gives us more displeasure than the joy of unexpectedly gaining $100. This factor tends to make us naturally risk averse and more concerned about unanticipated bad things than unanticipated good things.

In addition, we are usually talking about unexpected consequences of an action—rather than inaction—and acts of commission are more prone to regret (Gilovich and Medvec 1995). In a famous experiment, Kahneman and Tversky asked participants about the following scenario:

> Mr. Paul owns shares in company A. During the past year he considered switching to stock in company B, but he decided against it. He now finds out that he would have been better off by $1,200 if he had switched to the stock of company B. Mr. George owned shares in company B. During the past year he switched to stock in company A. He now finds that he would have been better off by $1,200 if he had kept his stock in company B. Who feels greater regret? (Kahneman and Tversky 1982)

Although the amount of money lost was the same for both men, an overwhelming 92 percent of respondents said Mr. George, the investor who got burned when he made an act of commission, would feel more regret.[1] Taking an action is less common and more salient than not taking an action, and—at least in the short run—a potential source of kicking ourselves after the fact. It is easy to imagine the counterfactual of doing nothing, and often, when our actions don't work out, we wish we had done just that. Nothing.

Why Are We So Blind?

Over the years, many people have written about unintended consequences. American sociologist Robert Merton wrote a classic paper on the topic called "The Unanticipated Consequences of Purposive Social Action" (Merton 1936) in which he identified five conditions that lead to unintended consequences. Two of these stand out as major culprits in the most common cases:

Lack of knowledge. Ignorance of sci-

ence or of human behavior makes it impossible to predict outcomes. The Israeli daycare investigators clearly lacked sufficient knowledge of parental behavior to predict the outcome of their experiment. Thankfully, the perverse effect they produced did not cause a major social or political problem.

Donald Rumsfeld has further articulated the problem of ignorance with his famous statement of the unknown unknowns problem:

> As we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don't know we don't know. And if one looks throughout the history of our country and other free countries, it is the latter category that tend to be the difficult ones. (Department of Defense 2002)

Sometimes we understand that certain pieces of information are missing, and we take a chance (or not) on the likely influence of these known unknown factors. But worse yet is the completely-out-of-the-blue unknown factor. I suspect the lobbyists for bankruptcy reform did not think far enough ahead to predict what overextended homeowners would do once bankruptcy was no longer an option. They also may not have known about the precarious nature of the mortgage-backed securities being promoted by the investment divisions of their banks.

"Imperious immediacy of interest," in which "the actor's paramount concern with the foreseen immediate consequences excludes consideration of further or other consequences of the same act" (Merton 1936, 901).

This category of mistake would include actions based on emotional impulse rather than deliberative decision-making. For example, the all-too-familiar case of military invasions that fail to anticipate what will happen after the initial attack.

In addition to Merton's factors, *groupthink*, as described by Irving Janis, is another phenomenon that has been frequently blamed for bad decisions, the classic example being John F. Kennedy's undertaking of the failed Bay of Pigs invasion of Cuba. According to Janis, groupthink emerges from a highly cohesive group and involves the "non-deliberate suppression of critical thoughts as a result of internalization of the group's norms" (Janis 1971, 44). Several aspects of the decision-making process used by Kennedy and his team seem to have produced a groupthink phenomenon, and after the invasion had been scrapped, Kennedy was reported to have said, "How could we have been so stupid?" (Janis 1971).

What Can Save Us from Unintended Consequences?

By now there has been over fifty years of rather vigorous research in decision-making—both about where it goes wrong and about how to improve it. Much of the effort to improve decisions is aimed at moving people from quick, intuitive decisions (what has come to be called System 1) to slower, more deliberative thinking (System 2). For example, a 2009 article in *Perspectives in Psychological Science* suggested that more effective decisions could be achieved by (a) trying to adopt an outsider's perspective on the question or (b) deliberately considering the opposite of the decision you are about to make (Milkman et al. 2009).

But perhaps some of the best advice comes from a familiar source: the basic principles of critical thinking and Carl Sagan's "Baloney Detection Kit" (Sagan 1997). Among Sagan's many good ideas, these seem particularly important:

- Encourage substantive debate on the evidence by knowledgeable proponents of all points of view.
- Spin more than one hypothesis.
- Try not to get overly attached to a hypothesis just because it's yours.
- If there's a chain of argument, every link in the chain must work (including the premise)—not just most of them (Sagan 1997, 210–211).

This last suggestion is particularly important when the policy or intervention under consideration sets off—or could reasonably be expected to set off—a chain of events. As Merton's "imperious immediacy of interest" suggests, often we are so focused on the initial, more easily predicted effects of a plan that we are blinded to the possible longer-term consequences.

But perhaps the biggest problem of all is one that is not adequately addressed by decision-making research and the principles of critical thinking alone: decision-makers have to *want* to make better decisions. Often decision-makers are driven by competing incentives. There is a strong push to do something immediately to address a pressing problem, or there are multiple motives bundled up in the decision-maker's thinking. For example, abstinence-only sex education programs are often promoted by groups with religious objections to contraception and abortion, and yet abstinence-only sex education has little effect on sexually transmitted disease infection rates (Underhill et al. 2007) and is associated with higher teen pregnancy and birth

But perhaps the biggest problem of all is one that is not adequately addressed by decision-making research and the principles of critical thinking alone: decision-makers have to *want* to make better decisions.

rates (Stanger-Hall and Hall 2011). Nonetheless, these programs continue because they are driven by philosophy rather than evidence.

Better policy outcomes will be achieved only when decision-makers are motivated to use the best modes of thinking and deciding. It may slow things down to consider all the alternatives and think through the likely chain of events, but if we take the time, perhaps we can avoid the next Bay of Pigs or the next Great Recession. ■

Note

1. There is no mention of the happiness or regret felt by Mr. John or Mr. Ringo.

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[SKEPTICAL INQUIREE BENJAMIN RADFORD

Benjamin Radford is a research fellow at the Committee for Skeptical Inquiry and author or coauthor of ten books, including *Bad Clowns*.

The Phoenix Driveway Ghost

Q: **I was watching a program on the Discovery Channel and saw you. I have tried very hard to get an explanation as to why this image appears on my driveway every night. I have a security camera that records this strange image; it looks like illuminated smoke or mist. It creeps up from the ground and travels across my driveway.... Can you review the tape and explain to me what's happening?**

—Kay M.

A: I received the above query from a woman named Kay, who lives in a suburb of Phoenix, Arizona. I replied asking for more details, which she supplied over the course of two or three emails (condensed here for clarity and brevity):

> It creeps up from the ground and travels across my driveway. When it reaches the other side it just rolls over the side of the driveway like water falling over a waterfall back into the ground. It's very bright and has no particular shape. It is sometimes big and sometimes smaller. It starts at the driveway nearest the house and every night it moves down further away from the house until it reaches the end of the driveway and then it starts over again. It sometimes changes shapes; sometimes it's smaller and sometimes it's larger. I have hours of video of this strange sighting. I attributed this image to the disturbances I've had in the house such as ringing, bumping, popping, and rattling noises. I've had knocks on the front door and nobody's there.... I've had my silverware turned upside down in the drawer and other nuisances in my kitchen. This is just a little of what's been happening to me.

I asked for a copy of the video, and she sent me a VHS tape of a grainy black and white surveillance video (the image was too low quality to reproduce; the above image is just for illustration). The time/date stamp read April 30, and the video covered that evening and the early hours of the next day. Sure enough, there was an eerie, round, glowing image that appeared from 22:20 (10:20 PM) until 2:15AM. It crossed the driveway, moving diagonally and very slowly. In fact the glowing ghost (if that's what it was) took about four hours to cross the driveway. I asked for a better quality video on DVD, but she only had a VCR hooked up to her security camera and could not provide it.

A few days later I got another email from Kay:

> Just to let you know, this thing on the driveway is very smart. I don't think it wanted to be recorded or it wanted to confuse me. From the 8th of June

> to the 20th it wasn't there. Then, on the 21st of June just as it was getting dark (about 7 PM), I went in to get the system set up and the image was there in the middle of the driveway. Before that, I think it just started early in the day and completed its trip across the driveway before I turned the camera on. That's why I say it's very smart.

Upon reviewing our correspondence, it was clear to me that Kay associated what was going on in her driveway with strange events in her home (such as popping noises, knocks on the front door, etc.) even though there was no clear connection. In her mind, these disparate phenomena were somehow related. This is fairly common in paranormal mysteries, where eyewitnesses will often lump random things together, confusing the issue and creating red herrings. I had no idea who might be knocking on her door or why she might hear rattling or popping (traffic, neighbors, and other ambient sounds seemed plausible), but I was not asked to investigate—nor was I given any evidence of—anything other than the driveway entity, so that's what I focused on.

It's important in investigations to determine the scope of the claims and not get bogged down with irrelevant information, as it's easy to go on a wild goose chase. I soon realized that I was dealing with an unreliable witness; while her information was interesting, it was important to stick with the facts and the evidence available. She was not only convinced that the glowing orb was sentient (and trying to trick her) but also that it was causing other minor mischief.

After doing some research, I concluded that the ghost or glowing entity Kay videotaped was in fact the reflection of the moon crossing her driveway—very, very, slowly. Though most people assume that asphalt, being black, absorbs rather than reflects light, oils in the tar do reflect light. The video itself shows this quite clearly; the white area in the top right hand corner of the image is light reflected from a street lamp. Thus we know that light can be reflected.

By consulting an almanac, I determined that the night of April 30 was a full moon. So there was a full moon that evening, which would have likely been reflected by the driveway. But my hypothesis falls apart (or is severely weakened) if the weather over Phoenix was overcast that evening. Further investigation revealed that the skies over Phoenix were clear that night, and the city had a high of 98° and a low of 74°. Further evidence for this solution was her information that "From the 8th of June to the 20th it wasn't there." Consulting a lunar calendar, I found that June 8 was the date of the last quarter of the moon, thus the moon was about half as illuminated as during a full moon. And, not coincidentally, the ghost reappeared around June 20—just before the first quarter of the full moon.

It's important in investigations to determine the scope of the claims and not get bogged down with irrelevant information, as it's easy to go on a wild goose chase.

This information was very strong evidence for a solution but didn't conclusively prove that the moon was mistaken for a ghost. I wanted to test my hypothesis with a falsifiable scientific test. I wrote to Kay and asked her to record the driveway on the night of May 13. Consulting my calendar, I saw that there would be no moon that night; if the mysterious image appeared on that night, then the image could not possibly be the reflected moon, and I'd have to keep looking for a solution. I queried her on May 15, asking to see the videotape. She replied about a week later: "I didn't have the camera pointed at the driveway on May 13. It didn't show itself for about a week."

At that point I considered my investigation complete. I had specifically asked for a key piece of evidence, and for whatever reason Kay didn't do as I instructed to collect that evidence. Perhaps she had in fact recorded the video and was embarrassed that the ghost hadn't appeared, as I predicted. Perhaps she just forgot. But Kay admitted that recorded or not, the ghost had not appeared that week, so either way my point had been made.

I patiently and diplomatically explained to Kay what I thought the solution to her mystery was, outlining for her my evidence, research, and reasoning. Kay wrote back to me saying, "I'm sorry but I disagree with you unless there is a full moon every night. I have taped this image over and over every night for months on end and I don't believe we have a full moon every night." (Of course the moon would not necessarily have to be full to appear in the video, and in any event the only tapes Kay ever sent me were recorded during full moons.)

She continued, "Thanks for your review, but I know it is something else. I've even taped this image during the day once and I don't think we can see the moon during the day." Kay never provided the daylight video for me to examine, so that evidence was not presented to me for analysis. And though I doubt that even a bright moon would be reflected through full daylight, it might be in the late afternoon since the moon is often visible during daylight. Kay just needed to look at the sky to test her theory.

Though I prefer to do field investigations when possible, I didn't have the budget to do an onsite investigation; it would have been both impractical and prohibitively expensive to fly to Phoenix and stake out this woman's driveway for days (or weeks). In any event, I had the video evidence I needed in the form of the videotape. Investigators must weigh the costs and benefits of an onsite investigation and work within their means while making a diligent effort to solve the case. I did the best I could and wonder if to this day Kay tells her friends and neighbors about her driveway ghost.

FIRE-BREATHING DINOSAURS?

Physics, Fossils, and Functional Morphology vs. Pseudoscience

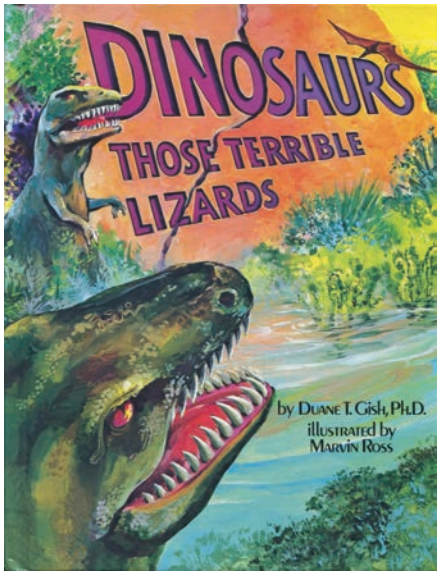
To support their claim that humans and dinosaurs coexisted, numerous antievolution publications—including grade-school science textbooks—assert that dragon legends were inspired by human encounters with fire-breathing dinosaurs. Here's why that's unrealistic.

PHILIP J. SENTER

Mainstream geologists and biologists accept the abundant physical evidence that the Earth is billions of years old; that all organisms are evolutionary descendants of a common ancestor; and that non-avian dinosaurs became extinct sixty-five million years ago (e.g., Gradstein et al. 2004; Prothero 2007). In contrast, young-Earth creationist (YEC) authors have long maintained that the Genesis account of creation and the biblical timeline are literally correct, placing the creation of the Earth and all types of organisms at approximately 6,000 years ago. A corollary of this position is that dinosaurs and humans were created on the same day and must therefore have encountered each other. The claim that dragon legends are based on such encounters has long been a

mainstay of YEC literature, and in 1977, biochemist and YEC author Duane Gish took this concept up a notch in his children's book *Dinosaurs, Those Terrible Lizards*, by positing that dinosaurs breathed fire. Other YEC authors followed suit (see references below), and dinosaurs now breathe fire in seventh-grade biology textbooks from BJU Press (Batdorf and Porch 2013; Lacy 2013).

In support of the idea that a real animal can produce fire, Gish (1977) cited the defense mechanism of bombardier beetles (Brachinus spp.), which spray a mixture of hydrogen peroxide and hydroquinone into the faces of would-be predators. Chemical catalysts cause the mixture to reach a scalding 100° C (Aneshansley et al. 1969). Subsequent YEC authors followed Gish's lead and added imaginary details such as sparks or explosions or flame (Phillips 1994; Hamp 2000; Isaacs 2010; Paul 2010). In reality, the beetles merely spray hot liquid—which scalds but does not produce flame—and therefore provide no biological precedent for organic fire production.



Some YEC authors have cited bioluminescent animals and electric eels as biological precedent for fire production (Morris 1984; Petersen 1986; Morris 1988; Niermann 1994; Morris 1999; DeYoung 2000; Petersen 2002). However, the processes that produce bioluminescence (Haddock et al. 2010) and bioelectrogenesis (Pough et al. 2013) are chemically unrelated to combustion and generate little or no thermal energy. These processes are therefore irrelevant to fire production and provide no biological precedent for it.

Proponents of the fire-breathing dinosaur hypothesis have suggested a number of potential mechanisms of fire production, reviewed below, each of which is a separate hypothesis in its own right. Below, I use scientific data to evaluate each hypothesis. Each such hypothesis implicitly predicts that the mechanism is not only physically possible but that it will not cause serious injury to the animal. Each hypothesis is falsified if either of those predictions is not met.

Exhalation of Pyrophoric Gas

Henry Morris (1984) and James Gilmer (2011) suggested that a fire-producing reptile could breathe out gases that would ignite upon contact with oxygen. A substance that ignites upon contact with air is said to be pyrophoric. When released into air from a container, a pyrophoric gas explodes after traveling only a few centimeters or millimeters from the opening (Tsai et al. 2010). Given this, a pyrophoric gas released from the nostril or throat of a dinosaur would have exploded immediately (Figure 1), burning the animal's face or throat. The serious harm that this would have caused the animal falsifies this fire-production hypothesis.

The hypothesis could be tenable if the nostrils were protected by a fire-resistant tissue, but animals produce no such tissue. Many animals produced heavily keratinized epidermal derivatives (hair, feathers, horn sheaths, etc.) that protect from abrasion, but these burn when exposed to fire, as do cuticles of collagen or chitin. If dinosaur snouts produced a protective, nonflammable, mineral covering (e.g., calcium carbonate or calcium phosphate), this covering would have fossilized, as is usual with hard animal parts. No such covering is present on the snout of any dinosaur fossil.

Ignition of Belched Methane

Herbivorous mammals emit large eructations (belches) of methane daily, averaging twenty-six per hour in cattle and forty-two per hour in sheep (Colvin et al. 1958; Ulyatt et al. 1999; Koch et al. 2009). John Morris (1999) suggested that herbivorous dinosaurs did likewise and secreted a pyrophoric material from a gland to ignite the belched methane.

However, once liberated from a container (such as a dinosaur's oral or nasal cavity), a gas immediately spreads in all directions; the methane would quickly surround the dinosaur's head. The pyrophoric gas would not only produce a nasal or oral burn as it emerged but would also ignite the cloud of methane-infused air around the animal's head, burning the surface of the head in the resulting fireball (Figure 1). The serious harm that this would have caused falsifies this fire-production hypothesis.

Human cases confirm that ignition of combustible belches causes facial burns. Eructation in humans usually involves the emission of swallowed air, which is methane-free and is not combustible. However, in adult cases of pyloric stenosis, combustible gases can accumulate in the stomach due to the fermentation of food in the stomach when passage to the duodenum is obstructed. When a patient belches those gases while smoking, the lit cigarette ignites the gases, and the resulting fireball causes facial burns (Galley 1954; MacDonald 1994).

Ignition of Methane by an Electric Organ

Several fish species have electric organs made of modified muscle cells called electrocytes, which are arranged in series so that their voltages are summed (Gallant et al. 2014; Sillar et al. 2016). Most electric fish spe-

cies generate weak, harmless pulses that are used to navigate, detect other fishes, and convey social signals (Lissmann 1958; Sillar et al. 2016). In contrast, electric eels (*Electrophorus electricus*) and torpedo rays (*Torpedo* spp.) produce pulses strong enough to stun prey (Sillar et al. 2016) or to cause serious harm or death to humans (Copenhaver 1991; Carlson 2015).

DeYoung (2000) and Gilmer (2011) proposed that dinosaurs possessed an electric organ, as in the electric eel, and used it to generate a spark to ignite metabolically produced methane. However, as we have seen, ignition of belched methane would envelop the animal's head in a fireball. Also, electric organs do not produce sparks.

A spark is an electrical discharge into air. The permittivity (a measure of how easily electric current flows through a material) of air and of methane are both low, approximately 1.0 (Wohlfarth 2013), whereas that of water is over 60 (Harvey 2013). For this reason, current generated by an electric fish travels easily through water or through biological tissue—which is mostly water—but not through air or methane. Because electrical current follows the path of least resistance, current flowing from one part of an animal to another will flow *through* the animal's tissues and will not jump an air-filled or methane-filled gap between body parts as a spark. For example, if a dinosaur had sufficient voltage between its upper and lower jaws for an electrical current to flow from one jaw to the other and the dinosaur opened its mouth and belched some methane, no spark would leap into the methane cloud; instead, the current would flow from one jaw to the other through the dinosaur's jaw muscles. There would be no spark, flame, or any other visible evidence that the electrical event had occurred (Figure 1). This fire-production hypothesis is therefore falsified.

Ignition of Fuel by a Spark Produced by Friction

Gilmer (2011) hypothesized that a dinosaur could use friction to produce a spark to ignite a combustible gas such as methane "in the mouth, throat, [or] internal organs." However, no animal produces a material that creates sparks in response to friction. The tough materials that animal bodies make—calcium phosphate, calcium carbonate, chitin, and keratinized integumentary derivatives—do not spark when rubbed together. Flint, which produces sparks when rubbed together, is a form of silica (SiO_2), a chemical that some microbes can precipitate (Erlich and Newman 2009). However, even if flint-producing microbes inhabited dinosaur mouths or throats, any methane ignited there would explode there, causing serious internal injury.

Internal organs are anoxic environments and therefore do not allow flame production. The one exception to this rule is the respiratory tract, but flame generated here

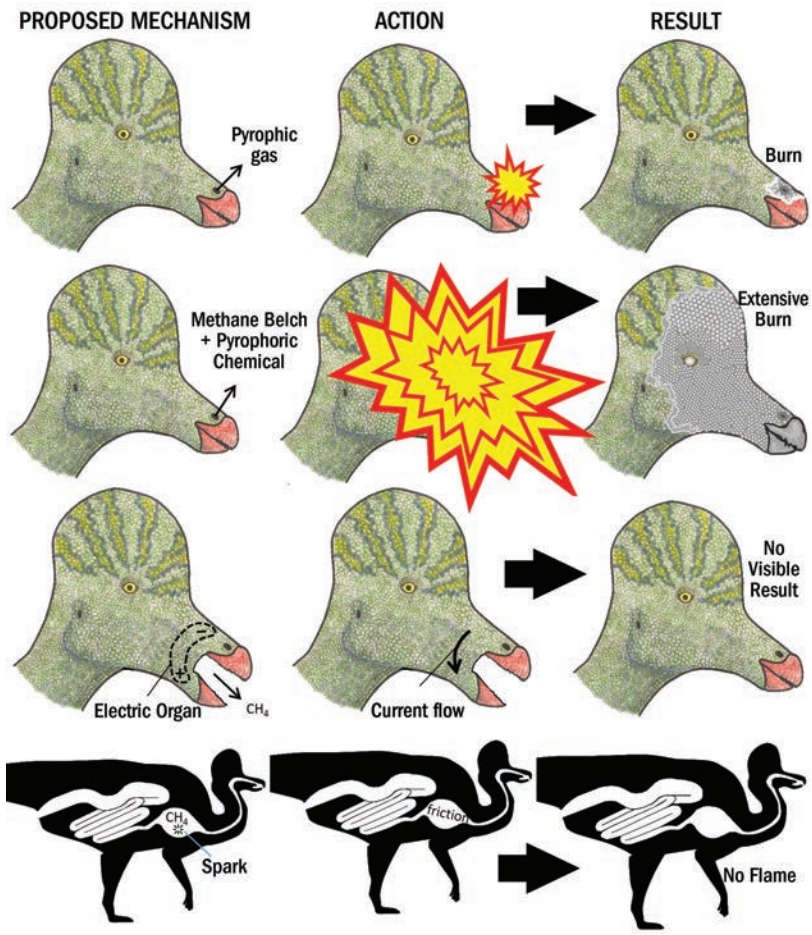


Figure 1.
The lambeosaurine dinosaur *Corythosaurus casuarius*, showing hypothesized mechanisms of fire production in dinosaurs and the results that would occur in a real animal. Note that some proposed mechanisms would cause harm to the animal, and the others would not actually produce fire.

causes severe injuries or death (Wöllmer et al. 2010). Even the digestive tract has too little O_2 gas in it to support flame (Levy 1954; Cunha et al. 2011) (Figure 1). This hypothesis is therefore falsified.

Emission of a Hypergolic Pair of Chemicals

Isaacs (2010), Batdorf and Porch (2013), and Lacy (2013) hypothesized that dinosaurs could produce fire by emitting a pair of chemicals that would ignite in the air upon contact with each other, after being sprayed from the mouth or nose. A pair of chemicals that spontaneously ignite when combined, without a separate ignition source, is termed *hypergolic*. A hypergolic pair of chemicals includes a fuel chemical and an oxidizing chemical. Numerous hypergolic pairs of chemicals are known, but most such chemicals are man-made and either do not occur in nature or—as in the case of liquid oxygen—must be chilled to temperatures that animal bodies cannot withstand. The two exceptions are hydrogen peroxide (an oxidizer) and ammonia (a fuel), both of which are produced by organisms. However, the fuels with which hydrogen peroxide is hypergolic—kerosene, pentaborane, or mixtures including hydrazine plus methanol (Sutton 2006)—are extremely toxic to organisms. Likewise, the oxidizers with which ammonia is hypergolic—liquid oxygen and liquid fluorine (Sutton 2006)—have boiling points too low (-183 °C and -188 °C, respectively [Compressed Gas Association 1990; Hammond 2013]) for organisms to withstand their presence as liquids. There is therefore no known hypergolic pair of chemicals the production of which organisms can withstand.

I use scientific data to evaluate each hypothesis. Each such hypothesis implicitly predicts that the mechanism is not only physically possible but that it will not cause serious injury to the animal. Each hypothesis is falsified if either of those predictions is not met.

Furthermore, emission of a pair of hypergolic chemicals would harm the animal if one or both chemicals were gaseous. Because a gas diffuses in all directions immediately upon release, a pair of gaseous hypergols would surround the dinosaur's head and envelop it in a fireball as they reacted with each other. If one hypergol were gaseous and the other liquid, then upon release the gaseous hypergol would immediately spread in all directions and reach the liquid hypergol's point of exit from the body, burning the animal in that location. These versions of the hypergol hypothesis are therefore falsified.

If both chemicals were liquid, they would have to be sprayed at such angles that the two streams would converge sufficiently far from the animal not to burn it. However, this version of the hypothesis is nonetheless falsified by the lack of any pair of hypergolic chemicals the presence of both of which animal bodies can withstand.

Lambeosaurine Dinosaur Crests

The duckbilled dinosaurs of the subfamily Lambeosaurinae had hollow crests, and in several YEC publications—including seventh-grade biology textbooks published by BJU Press (Batdorf and Porch 2013; Lacy 2013)—these crests are interpreted as storage or mixing chambers for combustible gases (Gish 1977; Petersen 1986; Morris 1988; Niermann 1994; DeYoung 2000; Petersen 2002). However, the crests' hollow passages are part of the respiratory tract (Evans et al. 2009). Anything stored or mixed there would have obstructed airflow, causing suffocation. In addition, the left and right passages are separate, which precludes mixing, except in a rear compartment that housed the olfactory epithelium (Evans et al. 2009). Anything mixed and combusted there would have destroyed the animal's sense of smell in addition to causing internal burns (Figure 2).

Connected to each of the left and right nasal passages in the lambeosaurine skull is a lateral diverticulum, a blind sac extending upward from the nasal cavity (Evans et al. 2009) (Figure 2). The diverticulum is lateral to the airway, so that a gland or storage facility housed there would not obstruct the airway. However, in today's archosaurs (crocodilians and birds), diverticula from the nasal passages house only air, not glands or storage structures (Witmer 1997; Witmer and Ridgely 2008). Furthermore, fire-production methods involving lambeosaurine lateral diverticula would have injured the animal. If the lateral diverticula housed glands that released pyrophoric chemicals into the air in the respiratory passages, this would have generated combustion inside the crest (Figure 2), causing internal burns. If a duct conducted pyrophoric chemicals to the nostril, ensuring that combustion occurred outside the crest, the tissue around the nostril would suffer burns (Figure 2). If each lateral diverticulum housed a gland that produced one of a pair of hypergolic gases, then upon exiting the nostrils the gases would diffuse in all directions and combust, enveloping the animal's snout (or possibly the entire head) in a fireball.

If each lateral diverticulum housed a gland that produced one of a pair of hypergolic liquids rather than gases, and if ducts conducted the liquids to the nostrils, and if the liquids were projected by muscular squeezing, and if the two streams of liquid converged far enough beyond the snout to avoid burning it when the two streams contacted each other and ignited, then the animal might have avoided injury. However, there is no bony indication of the presence of the requisite glands, ducts, or muscles in the lambeosaurine skull (Evans et al. 2009). Moreover, there is no pair of hypergolic chemicals for which animal bodies can withstand the production of both. This hypothesis is therefore falsified.

Cartilaginous Blasting Caps?

Isaacs (2010) hypothesized that dinosaurs possessed a "chunk of cartilage" that extended beyond the bony snout, as in mammals, and "may have housed a mixing region for chemicals and oxygen used for combustion." However, nasal cartilages do not host fire-production mechanisms in known animals. More important, if a cartilaginous "chunk" hosted combustion, the structure would have suffered burns, which falsifies this hypothesis.

Other Mesozoic Reptiles

Booker (2005) hypothesized that the enlarged cavity at the tip of the snout of the Cretaceous crocodyliform *Sarcosuchus* housed a fire source. Wieland (2005) and Paul (2010) suggested that the cavity was used to mix combustible gases. In seventh-grade biology textbooks, Batdorf and Porch (2013) and Lacy (2013) also implied that the cavity was used in fire production.

The appearance of an enlarged cavity at the tip of the snout in adult *Sarcosuchus* is due to developmental widening of the snout. In *Sarcosuchus*, juveniles are narrow-snouted, and the entire length of the snout widens during development, so that the snout tip is widened not by itself but along with the rest of the snout (Sereno et al. 2001) (Figure 3). The wide adult snout tip is therefore developmentally related to the width of the snout as a whole, not to any special function of the snout tip. Narrow-snouted crocodilians eat fishes nearly exclusively, whereas medium- and wide-snouted species are generalist predators with diets that include large prey (McHenry et al. 2006). The change in snout proportions in *Sarcosuchus* is therefore functionally related to a dietary switch as the animal grew.

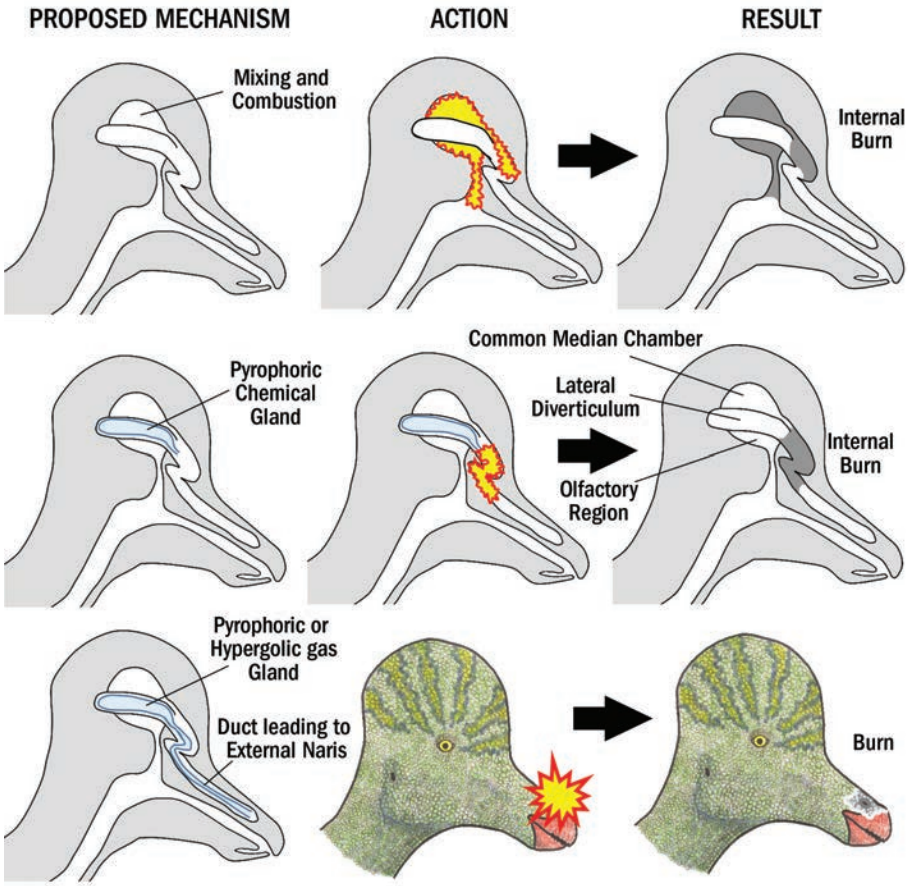


Figure 2.
Corythosaurus casuarius, showing hypothesized combustion-related functions for the crest. Note that all proposed functions would cause harm to the animal.

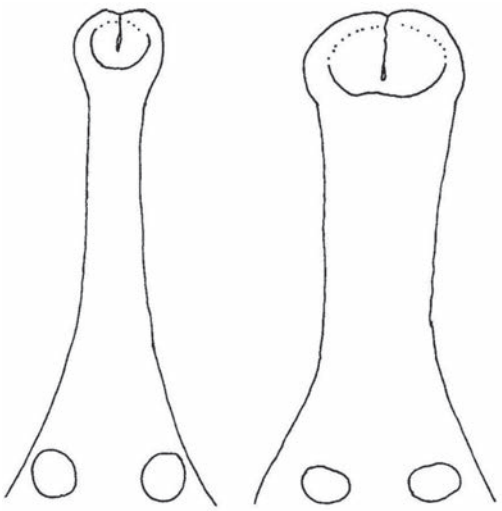


Figure 3. Snouts of juvenile (left) and adult (right) *Sarcosuchus imperator* in dorsal view, showing that the great width of the nostril in the adult is an artifact of ontogenetic widening of the entire snout. Modified from Sereno et al. (2001).

The widening of the snout, in combination with the lack of a bony internarial bar between the nostrils, yields the illusion of an enlarged cavity at the snout tip in *Sarcosuchus*. Most extant crocodilian species also lack a bony internarial bar and instead possess a soft-tissue septum that separates the nostrils (Iordansky 1973). There is no reason to suspect otherwise in *Sarcosuchus*, so a single, enlarged cavity is very unlikely in the fleshed-out animal. Even if it had existed, production of fire within it would have burned the animal, which falsifies this hypothesis.

Gilmer (2011) hypothesized that the crests of "some pterosaurs, such as the *Pteranodon*" "could store flammable gas . . . for use on demand." This hypothesis is anatomically unrealistic; in some crested pterosaurs it is possible that the crest contained air-filled diverticula of the nasal cavity or the middle ear cavity (Bennett 2001), but the crests are extremely thin in cross-section, with insufficient room for storage, and in extant archosaurs the nasal diverticula contain only air (Witmer 1997; Witmer and Ridgely 2008). Furthermore, in *Pteranodon* itself, there is no indication that the frontal bone, which makes up the entire crest, is invaded by nasal diverticula in the first place (Bennett 2001). This hypothesis is therefore falsified.

The Real Origin of Dragon Legends

The biological reality behind the origin of dragon legends has long been known. The word *dragon* is derived from the ancient Greek δράκων (*drakōn*) and the Latin *draco*, both of which meant "serpent." Many ancient Greek and Roman artifacts depict *drakōn*/*draco* myths, in all of which the depicted animal is a snake (Ogden 2013; Senter 2013). Greek and Roman works of natural history described the *drakōn*/*draco* as a snake. Some such works restricted the term to large, nonvenomous constrictors, especially the Aesculapian snake (*Zamenis longissima*) or African and Indian pythons (Senter 2013; Senter et al. 2016).

European dragon lore evolved in the Middle Ages. Rumors that dragons could fly and could produce fire had begun by the fifth century (Senter et al. 2016). By the tenth century, dragons were routinely depicted with feathered wings and a pair of limbs (Temple 1976; Mittman 2006). Depiction of dragons as quadrupeds with bat-like wings began in the thirteenth century and became common during the Renaissance (Allen and Griffiths 1979; Benton 1992; Absalon and Canard 2006; Morrison 2007). By the time nineteenth-century naturalists gave dinosaurs

their first scientific descriptions, European artists had been regularly portraying dragons with an uncannily dinosaurian or pterosaurian appearance for about four centuries. Speculation that human encounters with these animals had inspired dragon legends naturally followed, and YEC literature now routinely portrays dinosaurs as fire-breathers. But as shown here, that is unrealistic, and its continuance in science textbooks is downright irresponsible.

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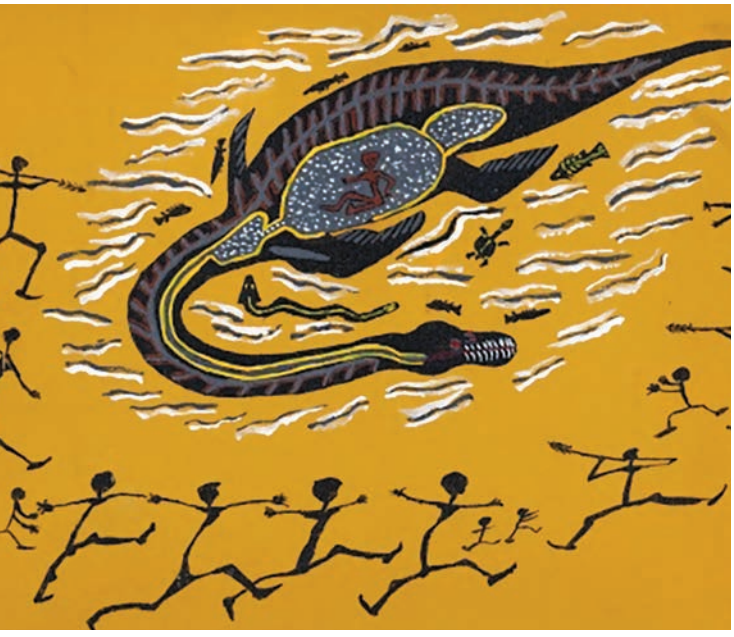
DID AUSTRALIA'S ABORIGINES SEE PLESIOSAURS? YES—IN A CHILDREN'S BOOK

To support their claim that humans and plesiosaurs coexisted, antievolution publications cite as evidence a plesiosaur painting by an artist of the Kuku Yalanji tribe of Australia. However, the painting is actually a copy of an illustration in a 1960 children's book on dinosaurs.

PHILIP J. SENTER

According to the young-Earth creationist (YEC) worldview, God created the Earth and the rest of the universe during a single week about 6,000 years ago, and he created humans and other kinds of organisms independently during the same week, as described in Genesis. This view rejects the abundant physical evidence that the Earth is over 4.5 billion years old (Gradstein et al. 2004), that the universe is billions of years older than that (Lineweaver 1999), and that all organisms evolved from a common ancestor over billions of years (Prothero 2007).

According to the physical evidence, non-avian dinosaurs and other monstrous reptiles such as pterosaurs, mosasaurs, and plesiosaurs became extinct at the end of the Mesozoic Era, 65 million years ago (Wicander and Monroe 2016), and the human species (*Homo sapiens*) did not come into being until about 200,000 years ago (McDougall et al. 2005). Humans and the monstrous reptiles of the Mesozoic Era are therefore separated by millions of years. To cast doubt upon the separation of humans and such beasts by millions of years—and by extension to cast doubt upon the passage of millions of years—YEC authors frequently cite archaeological "evidence" that ancient people came into contact with such reptiles. Such "evidence" usually consists of ancient, medieval, or more recent artwork that depicts creatures that the YEC authors claim are dinosaurs, pterosaurs, or plesiosaurs. Many such claims have been investigated and shown to be incorrect and based on taxidermic hoaxes or misidentifications of depictions of extant animals (Senter 2012; 2013; Senter and Wilkins 2013; Senter et al. 2013; Senter and Klein 2014).



Young-Earth creationists claim that this painting by a member of the Kuku Yalanji tribe of Queensland, Australia, proves that humans and dinosaurs coexisted.

Here I report an investigation of a similar claim in which the animal was correctly identified as a plesiosaur, but the artifact was incorrectly identified as evidence for the coexistence of humans and plesiosaurs. As it happens, the artifact is evidence of the coexistence of humans and a children's book.

Plesiosaurs are marine reptiles from the Jurassic and Cretaceous Periods of the Mesozoic Era, with forelimbs and hindlimbs that are modified into flippers. They include two main groups: pliosauroids and plesiosauroids. The former are short-necked reptiles with large heads and long snouts. The latter are mostly long-necked animals with small heads (Carroll 1988).

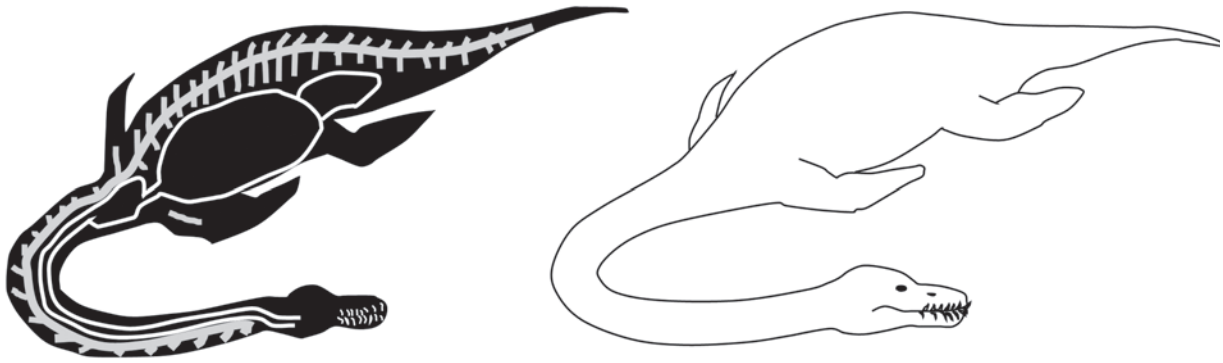


Figure 1. A copy of the plesiosaur in the Kuku Yalanji painting, with some details omitted (left); and the outline of Rudolph Zallinger's painting of the plesiosaur Elasmosaurus on page forty-seven of *The Giant Golden Book of Dinosaurs* (Watson 1960) (right).

In 1998, the YEC magazine *Creation* published an article titled "Australia's Aborigines…Did They See Dinosaurs?" by Rebecca Driver (1998). The article included a photo of a painting of a plesiosaur displaying its digestive tract and spinal column, in the "X-ray vision" style that is common in the art of Aboriginal Australians. According to Driver, the painting had been donated to the YEC organization Answers in Genesis and had been painted by a member of the Kuku Yalanji tribe of Queensland, Australia, at the request of a missionary. The missionary had asked one of the tribe's artists to paint a Kuku Yalanji story in which a monster called Yarru, which lived in a water hole, swallowed a maiden. In the painting, Yarru is depicted as a long-necked, small-headed, flippered animal resembling a plesiosaur (Figure 1). According to Driver, "the tribal artist, with very little formal education, had no knowledge of what so-called prehistoric animals looked like, and was drawing only from the descriptions handed down in ancient stories." Driver included the painting as "evidence" that humans from Australia had encountered live plesiosaurs.

The painting generated much interest in YEC circles. Several YEC authors subsequently cited it as "evidence" of human-plesiosaur coexistence (Hovind n.d.; Jerlström 1998; Genesis Park 1999–2017; Goertzen 2001; Gilmer 2011; 2013; Woetzel 2012). One author even asserted that the digestive tract in the painting indicated "that these animals had been hunted and butchered" (Jerlström 1998), an assertion that others repeated (Genesis Park 1999–2017; Woetzel 2012; Gilmer 2013).

The painting was cited by proponents of both sides of a controversy within the YEC community over the famous *Zuiyo-maru* carcass. The carcass had been hauled aboard the Japanese fishing vessel *Zuiyo-maru* in 1977. As widely circulated photographs show (see reproductions in Kuban 1997), it looked remarkably like a plesiosaur. However, biochemical testing and diagnostic anatomical features demonstrated that the carcass was that of a badly decomposed shark (Kuban 1997). A flurry of articles in YEC journals endorsed the conclusion that the carcass was that of a large shark—probably a basking shark (*Cetorhinus maximus*), given its large size (Wood 1997; 1998; Jerlström and Elliott 1999; 2005; Jerlström and de Roos 2005). To their credit, some YEC authors even conducted studies of new carcasses of basking sharks, pointing out that specific aspects of the decay process in that species produced carcasses that matched the details of the *Zuiyo-maru* carcass (Jerlström and Elliott 1999; 2005; Jerlström and de Roos 2005); for example, after the jaws and gill arches fall off early in the decay process, basking shark carcasses gain a superficially plesiosaur-like shape with the braincase and anterior torso vertebrae resembling a small head on a long neck.

Nonetheless, other YEC authors insisted that the *Zuiyo-maru* carcass was that of a plesiosaur (Bowden 1998; Zillmer 1998; 2005; DeYoung 2000; Goertzen 2001; Pe-

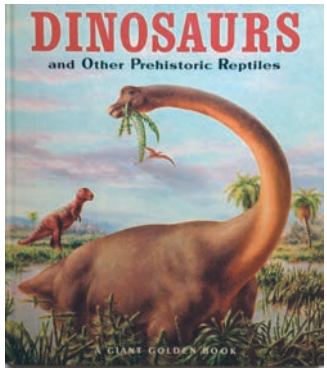
In 1977, the Japanese fishing vessel *Zuiyo-maru* hauled aboard a carcass that many young-Earth creationists claimed was a plesiosaur. Tests showed that it was the carcass of a badly decomposed shark.

tersen 2002), and one author used the Kuku Yalanji painting as part of his argument. YEC author John Goertzen (2001) pointed out that the Kuku Yalanji painting appears to show a dorsal fin protruding above the dorsal surface of the animal at the shoulder. Although other YEC authors identified that fin as the right pectoral fin (fore-fin) (Jerlström and Elliott 1999), Goertzen (2001) correctly pointed out that it is narrower than the left pectoral fin in the painting and that it lacks the bend in the middle of the fin that is present in the left pectoral fin in the painting. Goertzen identified this narrower fin as one of a pair of dorsal fins that he said the *Zuiyo-maru* carcass sported, although in reality the carcass retained only a single dorsal fin that was quite broad, not narrow (Kuban 1997).

Regardless of the identity of the fin in question, the Kuku Yalanji painting does look remarkably like a plesiosaur. How could a Kuku Yalanji artist depict a plesiosaur so well without his ancestors having coexisted with them? With a little help from a children's book. The Kuku Yalanji painting is a copy of Rudolph Zallinger's painting of the plesiosaur *Elasmosaurus* from page forty-seven of Jane Watson's *The Giant Golden Book of Dinosaurs* (Watson 1960). The Kuku Yalanji artist added the digestive tract and vertebral column, but the outline of the animal is a precise reproduction of Zallinger's painting (Figure 1), right down to the orientation of the neck, the bend in the middle of the left pectoral and pelvic fins, and the domed shape of the head. The fin in the painting that Goertzen (2001) mistook for a dorsal fin is actually the right pectoral fin, which the Kuku Yalanji artist depicted with the same shape and dimensions as in Zallinger's painting (Figure 1).

The Kuku Yalanji painting is a poor piece of evidence that people had "hunted and butchered" plesiosaurs, because it does not reflect accurate knowledge of plesiosaurian anatomy. In the Kuku Yalanji painting, the plesiosaur's head has a domed shape that is absent in real plesiosaur skulls but is present in Zallinger's painting. In the Kuku Yalanji painting, each of the vertebrae of the torso bears a prominent, downward-pointing spike, a feature absent in actual plesiosaur trunk vertebrae. Also, the intestine in the painting is short, broad, and straight, unlike the long, narrow, coiled intestines of reptiles.

The YEC community did get one important thing right: the animal in the Kuku Yalanji painting is indeed a plesiosaur. However, it was copied from a painting in a children's book, not from "descriptions handed down in ancient stories." The Kuku Yalanji painting is not evidence of human coexistence with plesiosaurs. Rather, it is evidence of human coexistence with *The Giant Golden Book of Dinosaurs*.



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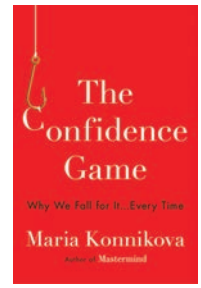
Maria Konnikova Wins CSI's Balles Prize in Critical Thinking for *The Confidence Game*



PAUL FIDALGO

In her acclaimed bestselling book *The Confidence Game: Why We Fall for It…Every Time*, *New Yorker* staff writer Maria Konnikova reveals the nefarious tricks of the con artist's trade, showing us how frauds and charlatans manipulate us by playing on our vulnerabilities and what we perceive to be our best qualities. She does so with a sincere empathy for those who have been deceived and an eye toward helping us all recognize our own biases. It is for this timely and indispensable work that Maria Konnikova will be awarded the 2016 Robert P. Balles Annual Prize in Critical Thinking by the Committee for Skeptical Inquiry.

"Cons work so widely because, in a sense, we want them to," writes Konnikova. "We want to believe the tale." In *The Confidence Game*, Konnikova uses exhaustive research and absorbing narratives to lay bare the methods used by con artists to compel us to act against our own interests; in so doing, she reveals how even the smartest—and most skeptical—among us are utterly susceptible to being fooled.

"*The Confidence Game* could not have come at a more crucial time, as the general public is overwhelmed day in and day out by attempts to play on their biases and prejudices," said Barry Karr, executive director of the Committee for Skeptical Inquiry. "Not just by individual con artists but by industries, media outlets, and faceless algorithms."

"But Maria Konnikova's book also provides an invaluable lesson for the skeptic movement, where we often presume we're too smart to be fooled by hucksters," said Karr. "Konnikova shows us that we are all vulnerable, that we all have beliefs about ourselves and the world that we want to see reinforced. We need to understand that any of us can be victims, and that being a victim doesn't equate to being gullible."

The Robert P. Balles Annual Prize in Critical Thinking is bestowed by the Committee for Skeptical Inquiry, publisher of the *Skeptical Inquirer* and a program of the Center for Inquiry. Konnikova will receive the prize at the 2017 CSICon conference October 26–29 in Las Vegas. The conference will also feature speakers such as Michael Mann, Lawrence Krauss, Cara Santa Maria, James Randi, Richard Dawkins, and many more. See CSIConference.org for more information.

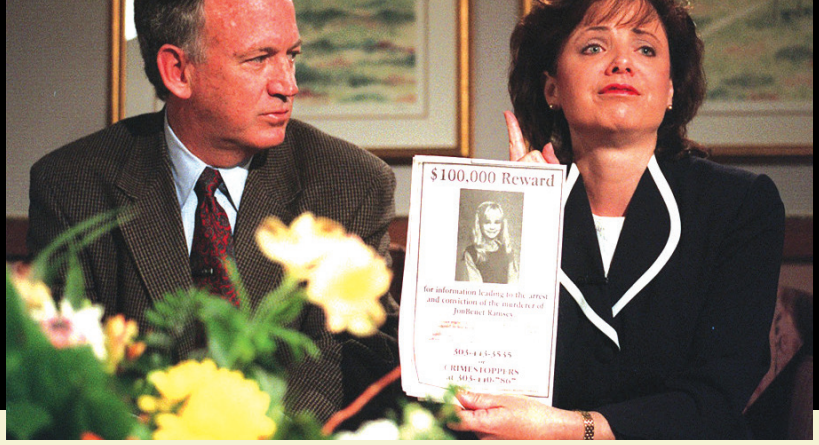
The Balles Prize is a $2,500 award given to the creator of the published work that best exemplifies healthy skepticism, logical analysis, or empirical science. The prize was established by Robert P. Balles, a practicing Christian, along with the Robert P. Balles Endowed Memorial Fund, a permanent endowment fund for the benefit of CSI. Previous winners of the Balles Prize have included Julia Belluz of Vox.com, the writers and producers of *Cosmos: A Spacetime Odyssey*, Paul Offit for his book *Do You Believe in Magic?*, Michael Specter for his book *Denialism*, and Natalie Angier for her book *The Canon: A Whirligig Tour of the Beautiful Basics of Science*.

Paul Fidalgo is communications director for the Center for Inquiry, which includes the Committee for Skeptical Inquiry.

JonBenet Murder Mystery Solved? (Not by Psychics)

The death of six-year-old beauty queen JonBenet Ramsey went unsolved for two decades.
Psychics were worse than useless, but the author's proposed solution resulted from evaluating the best evidence.

JOE NICKELL



On the day after Christmas 1996, child beauty-pageant star JonBenet Ramsey, age six, was found dead—garroted and her skull broken—in the basement of her family's home in Boulder, Colorado. As police vied with the district attorney's office over incompatible theories, the mystery of the little girl's death became a national media sensation, but it never led to an arrest. The case is a complex puzzle—not only with many pieces to sort out and fit into place but with some bogus pieces tossed into the mix.

I have worked privately on this case over the years. Unfortunately, I lacked the direct access (to police files, crime-scene evidence, etc.) that I had when I was enlisted to investigate homicide cases (e.g., Nickell 2007; Nickell with Fischer 1992, 107–129; Nickell and Fischer 1999, 39). Still, much essential evidence in the Ramsey case has now become publicly available.

What I present here is *not an accusation* but an exercise in trying to select and interpret the best evidence for "One of the greatest unsolved crimes in history" (*Murder* 2016).

Mr. Ramsey,

Listen carefully! We are a group of individuals that represent a small foreign faction. We do respect your business but not the country that it serves. At this time we have your daughter in our possession. She is safe and unharmed and if you want her to see 1997, you must follow our instructions to the letter.

You will withdraw $118,000.00 from your account. $100,000 will be in $100 bills and the remaining $18,000 in $20 bills. Make sure that you bring an adequate size attache to the bank. When you get home you will put the money in a brown paper bag. I will call you between 8 and 10 am tomorrow to instruct you on delivery. The delivery will be exhausting so I advise you to be rested. If we monitor you getting the money early, we might call you early to arrange an earlier delivery of the money and hence a earlier pick-up of your daughter. Any deviation of my instructions will result in the immediate execution of your daughter. You will also be denied her remains for proper burial. The two gentlemen watching over your daughter do particularly like you so I advise you not to provoke them. Speaking to anyone about your situation, such as Police, F.B.I., etc., will result in your daughter being beheaded. If we catch you talking to a stray dog, she dies. If you alert bank authorities, she dies. If the money is in any way marked or tampered with, she dies. You will be scanned for electronic devices and if any are found, she dies. You can try to deceive us but be warned that we are familiar with Law enforcement countermeasures and tactics. You stand a 99% chance of killing your daughter if you try to outsmart us. Follow our instructions and you stand a 100% chance of getting her back. You and your family are under constant scrutiny as well as the authorities. Don't try to grow a brain John. You are not the only fish in the sea so don't think that killing will be difficult. Don't underestimate us John. Use that good southern common sense of yours. It is up to you now John!

Victory!

S.B.T.C

Death of JonBenet

At about 5:52 AM on December 26, the girl's mother, Patsy Ramsey, called 911 to report her daughter missing—although a ransom note Mrs. Ramsey had found on the kitchen stairs warned that alerting authorities would result in her daughter being killed; ditto talking to anyone else, although she also called friends.

Responding to the emergency call, two police officers arrived separately at 755 Fifteenth Street and looked around, but they did not see any evidence of breaking and entering.

The ransom note was addressed to JonBenet's father, John Ramsey (see below).

The patrol sergeant called for additional officers, a crime-scene investigation (CSI) crew, and what are known as victim advocates to comfort and assist the Ramseys. Unfortunately, the house was not vacated and guarded as a crime scene, and a Ramsey friend, Fleet White, even went looking in the basement. In a large room with a model railroad, he saw a broken window, picked up a piece of glass, putting it on the ledge, and moved a suitcase to look for other pieces. He had unthinkingly altered part of the crime scene (although it would be learned that John Ramsey had himself broken the window on an earlier occasion, when he had locked himself out of the house). Also, an advocate followed behind a fingerprint technician, using spray cleaner to tidy up as he finished with the area (Ramsey with Chapian 2012, 12; Thomas with Davis 2000, 18–27).

About one o'clock that afternoon, detective Linda Arndt initiated a further search with White and Ramsey. Ignoring her suggestion to begin at the top floor and work their way down, Ramsey headed straight for the basement, "a warren of rooms, closets, nooks, and crawl spaces" (Thomas with Davis 2000, 27). There, in a little room lacking a window, he discovered the lifeless body of JonBenet. She lay face up with her arms extended above her head. She was dressed in a white knit top and white long underwear over an "oversized" pair of floral-print panties. A pink nightgown was in the white blanket that she was neatly tucked into (Wecht and Bosworth 1998, 23; Thomas with Davis 2000, 28, 42; Douglas and Olshaker 2000, 284; Gentile and Wright 2003, 306). Ramsey ripped off duct tape covering her mouth, picked up the stiffened little body, and—carrying it upstairs—placed it on the floor close to the front door. Arndt noticed the smell of decomposition when she reached to the neck to feel for a pulse. Ramsey put a quilt over the body, and someone covered the feet with a sweatshirt. He lay down to put his arm around the dead child and stroked her hair, while Patsy came and fell across the body. All of these actions, and more, seriously compromised any future evidence collecting (Thomas with Davis 2000, 27–30; Wecht and Bosworth 1998, 22–26).

The following day, when the coroner began to autopsy the forty-five-pound corpse, he saw a loop of white cord loosely around the right wrist and a loop on the opposite end as if it had previously secured the left wrist as well. A length of similar white cord was wrapped tightly about the neck, and a piece of broken artist's paintbrush was in place where it had been used as a twisting handle for the garrote. (It was later found to have come from a brush belonging to Patsy Ramsey and to match a piece of the brush's bristle end, although the bottom third was never discovered[1] [Gentile and Wright 1993, 211].) Slivers from the broken paintbrush were found on the floor of the room where the body was found, indicating it was the site of the garroting (*Killing* 2016). The upper

Mr. Ramsey,

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Any deviation of my instructions will result in the immediate execution of your daughter. You will also be denied her remains for proper burial. The two gentlemen watching over your daughter do [not] particularly like you so I advise you not to provoke them. Speaking to anyone about your situation, such as Police, F.B.I., etc., will result in your daughter being beheaded. If we catch you talking to a stray dog, she dies. If you alert bank authorities, she dies. If the money is in any way marked or tampered with, she dies. You will be scanned for electronic devices and if any are found, she dies.

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You and your family are under constant scrutiny as well as the authorities. Don't try to grow a brain John. You are not the only fat cat around so don't think that killing will be difficult. Don't underestimate us John. Use that good southern common sense of yours. It is up to you now John!

Victory!
S.B.T.C (Thomas with Davis 2000, 13–18)

right side of the little girl's skull had been caved in by a severe blow, leaving a rectangular imprint.

Among other findings were a heart drawn with red ink on the left palm, an empty stomach (but the upper digestive tract contained bits of pineapple), and, at the hymeneal opening, an abrasion. Petechial (pinpoint) hemorrhaging in the eyelids indicated her heart was still pumping at the time the choking occurred (Thomas with Davis 2000, 41–43). More on this later.

Search for an Outsider

While from the outset the Boulder police suspected the Ramseys, District Attorney Alex Hunter commissioned retired homicide detective Lou Smit to conduct an independent investigation. Like the Ramseys, he was very religious and prayed with them (Ramsey with Chapian 2012, 124–126).

Shortly after entering the case, Smit embraced the theory that an outsider—a pedophile targeting the child beauty queen—was responsible (Douglas and Olshaker 2000, 319). He found an unlocked grate and window leading to the basement. Although the window was small and still partially covered by an intact spider web (*Case* 2016), he stubbornly defended this as an entry point for an intruder. (When he himself went through the space to test his theory, the film shows his trim body spanning the entire width of the window [*Killing* 2016].)

Although JonBenet did not suffer penile penetration (some experts concluded the frontal vaginal redness and abrasion could have been due to her known vaginitis or even rough wiping), Smit had a theory. He thought the offender had entered the child's bedroom and used a stun gun to immobilize her, based on certain odd markings on her body. The use of a stun gun or taser only made sense in terms of an outsider scenario, and, if proved, would seem to clear the Ramseys.

However, Stephen Tuttle, an expert on the brand of taser (Air Taser) that was supposedly identified, stated that the only similarity was the spacing between the two marks on JonBenet's back. Only a single mark appeared on the side of her face. "We have never seen those types of marks when you touch somebody with a stun gun," Tuttle said. "We are talking hundreds of people that have been touched with these devices. I can't replicate those marks" (Anderson 2001; see also *Case* 2016). Famed criminalist Henry Lee and others suggested the set of paired marks on her body was caused by the ends of a segment of the basement's toy-railroad track being poked at her, perhaps in an attempt to rouse her from unconsciousness (*Killing* 2016).

Smit had suggested that after supposedly rendering JonBenet unconscious (which the Air Taser would not do, according to its expert [Anderson 2001]), the perpetrator set about his nefarious work: He taped her mouth, carried her to the basement, choked her in an erotic fantasy, and sexually abused her digitally (Douglas and Olshaker 2000, 319).

Smit amassed other evidence for the outsider scenario—DNA traces on her clothing, for example, as well as a single pubic hair on her blanket, an unidentified palm print discovered on the door, and some other possible evidence. Boulder police and several experts tended to regard such evidence as doubtful and likely due to contamination (Douglas and Olshaker 2000, 319–320; *Case* 2016).

As to the bizarre ransom note, Smit believed the intruder had written it after first entering and exploring the house. Then he hid until the family returned home and waited until all were asleep before going to JonBenet's bedroom. To say the least, the combined ransom and molestation scenario appears farfetched—especially to skeptics of the outsider hypothesis who rely on evidence that the ransom note was written after the child's death—strong corroborative evidence that it was an inside job.

An Insider's Work

Of course the outsider hypothesis disappears like a phantom if JonBenet's mother wrote the ransom note. Let's revisit the peculiar text.

A "foreign faction" indeed. The note is wordy ("At this time we have your daughter in our possession," rather than simply, "We have your daughter"). It is replete with irrelevancies and implausibilities, and even borrows expressions from the 1994 movie *Speed* (whose extortionist character played by Dennis Hopper says, "You know that I'm on top of you. Do not attempt to grow a brain") and the 1971 Clint Eastwood movie *Dirty Harry* (which has the lines, "If I even think you're being followed, the girl dies. If you talk to anyone, I don't care if it's a Pekinese . . . the girl dies"). The amount of ransom asked for was almost exactly that of a bonus John Ramsey had previously received (Cheer and Rahman 2016).

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This laughably phony ransom note was surely not part of any kidnapping. It only makes sense as a staged element in a cover-up of the killing. But who wrote the two-and-a-half-page contrivance?

Early on, police did not think the Ramseys were acting normally. Detective Arndt said John Ramsey was oddly "cordial" when he greeted her. Also, the couple did not try to console each other. Officers found it suspicious that Burke, almost ten, was still in his

room. One saw Patsy Ramsey, although sobbing, slyly watching them through splayed fingers (*Killing* 2016).

Police soon discovered that the note was written on a notepad *belonging to Patsy Ramsey*. One leaf in the pad (number 26) has the beginning of an earlier draft, "Mr. and Mrs.," followed by a downstroke that was likely the beginning of an *R*. Leaves 17–25 were missing, but the ink writing from leaf 25 had bled through onto 26, suggesting that some of the last of those leaves could have been used for still another draft. Finally, leaves 27–29 matched the ragged top edges of the ransom note, proving they came from Patsy Ramsey's notepad (Thomas with Davis 2000, 73).

Of seven fingerprints found on the writing pad, one was left by a police sergeant, another came from a forensic examiner, and the remaining five were those of Patsy Ramsey. The ink of the writing on the ransom note exactly matched that of a black water-based ink Sharpie that also belonged to Mrs. Ramsey—according to the U.S. Secret Service document laboratory (where I was once given a VIP tour). The lab maintains a federally mandated Ink Library containing many thousands of reference samples (Thomas with Davis 2000, 54, 152). (Recall that the wood used for the garrote came from a paintbrush that belonged to her as well.) And there was much more.

Forensic Document Examination

As to the all-important handwriting of the note, some sources have asserted that it was never linked to Patsy Ramsey. That is untrue. Others—John Ramsey, of course, and son Burke—were ruled out as authors, but she was not. The Colorado Bureau of Investigation compared her handwriting samples to the writing on the note, but there were problems. The questioned writing, for one thing, lacks the smoothness (from good motor control) of Mrs. Ramsey's normal writing (see for yourself at Gentile and Wright 2003, 399–407). During a fourth session with her, however, in 1997, the forensic document experts had a surprise: they asked her to write a specimen *using her left hand*.

The result was striking. One leading expert—one I know personally and regard as absolutely top tier—gave a very definite opinion, identifying Patsy Ramsey as the author: "I am absolutely certain that she wrote the note." He is Gideon Epstein,[2] who began his career as Chief of the Questioned Document Division, U.S. Army, then became Senior Forensic Document Examiner with the National Laboratory Center, Bureau of Alcohol Tobacco and Firearms. He established the Immigration and Naturalization Service Forensic Document Laboratory in 1980, where he then served until retiring in 2000. A past president of the American Society of Questioned Document Examiners and a fellow of the American Academy of Forensic Sciences, he is now in private practice in Rockville, Maryland.

According to Epstein's sworn testimony, "The handwriting on the ransom note is a classic example of an attempt to disguise the true handwriting habits of the writer" (Epstein 2002, 97–98). Epstein, referring to "the poor line quality of the ransom note writing," added that while stress could have played a factor, "I felt there was more evidence of a conscious attempt to disguise" (Epstein 2002, 98–99). Regarding his examination of Patsy Ramsey's handwriting in comparison to that of the ransom note he stated: "After I concluded that examination, which was more than 1150 hours of work, I felt that I had identified sufficient significant handwriting characteristics with no significant differences." He went on to emphasize that regarding another examiner's finding of some alleged differences between Patsy Ramsey's writing and that of the note: "There are no significant differences. There are variations to the same basic handwriting patterns, but there are no significant differences" (Epstein 2002, 89).

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Scenario of Death

The identification of Patsy Ramsey as author of the pseudo–ransom note points directly to one of the Ramseys. I have always doubted, however, that either of the parents was the killer. Among other reasons, I question why one would conspire to protect a guilty other. But both, I have always thought, would be quick to protect their son Burke. One can easily understand how—having lost one child—they would join to prevent losing another. Might the never-identified acronym, "S.B.T.C.," written below the word "Victory!" on the fake ransom note, stand for "Save Burke Through Christ"?

While police focused largely on the Ramseys, Patsy seemed the most suspected, Burke the least. The District Attorney's office bought into Smit's intruder notions, and—while a grand jury recommended indicting John and Patsy (for child abuse resulting in JonBenet's death)—D.A. Alex Hunter concluded there was insufficient evidence for filing charges. In 2008, his successor, Mary Lacy, actually sent the Ramseys a letter rashly declaring them "completely cleared" and apologizing for their treatment. The following year the Boulder police reclaimed the case, reopening the investigation (*Killing* 2016).

Let us pause here to review the cause of death, which according to

the autopsy report (Meyer 1996) was "asphyxia by strangulation associated with craniocerebral trauma." Those who have suspected Patsy Ramsey have postulated that she may have injured her daughter in a fit of rage in which the child's head hit against, say, the bathtub; the ligature followed later, as part of the staging of the scene (see e.g., Thomas with Davis 2000, 286–287). Actually, although it is not precisely certain which trauma came first, the petechial hemorrhages—such as on the insides of the eyelids—together with relatively minimal bleeding from the head blow, are indications that the strangulation occurred first (Wecht and Bosworth 1998, 254–256; Douglas and Olshaker 2000, 285; Schiller 1999, 156, 467).

This would seem to be confirmed by the presence of short curved marks on JonBenet's neck, thought to have been left by her fingernails as she clawed at the cord in a vain attempt to relieve the choking (*Killing* 2016). But this remains controversial.

If the strangulation did precede the head blow, then the garroting was not done as staging; it may also not have been intended to kill. Famed pathologist Cyril Wecht calls attention to the little-discussed practice of auto-erotic asphyxiation, usually carried out by males attempting to "heighten the sexual experience during masturbation." In the case of JonBenet, Wecht postulates "an extraordinary act—a vicarious form of auto-erotic asphyxiation." As he explains, "Someone had found sexual stimulation by forcing JonBenet to experience the terribly uncomfortable and even terrifying effect of this near strangulation; at least it was supposed to be near strangulation" (Wecht and Bosworth 1998, 58–62).

However, such activity is inherently dangerous: If the vagus nerve (extending from the brain along either side of the neck and controlling many body organs) is pinched and its electrical messages interrupted, respiratory and cardiac functions may cease. Thus JonBenet's death "would have been inexplicable to the one who had ignorantly applied the fatal pressure to her neck" (Wecht and Bosworth 1998, 61).

While Wecht thought the assailant was "probably an adult," males as young as nine are known to have engaged in sexual asphyxia (Brody 1984), and Burke was only a month shy of ten. Also there is a nonsexual practice among some children as young as six (largely but not exclusively males) involving strangulation either by oneself or by another. It is called the "choking game" and is intended to cause a brief state of euphoria. (It is also called the "pass-out game," "blackout game," "space monkey," scarf game," and other names. It is known at least as early as 1995 [Russell et al. 2008].)

Nevertheless, in the Ramsey case, a sexual element seems established by the autopsy. Although JonBenet had not been raped per se, the evidence, insists Wecht—some non-extensive abrasion and damage to the hymen—indicated sexual molestation by a slender object such as a finger (Wecht and Bosworth 1998, 94–99). Some "birefringent foreign material" in the vagina led to speculation that it came from a shard (of varnish perhaps) from the broken paintbrush (from which a piece was used for the garrote, the end section having gone missing) (Meyer 1996; Thomas with Davis 2000, 305; cf. Wecht and Bosworth 1998, 97).

There are both further evidence and credible speculations that the assailant could have been Burke Ramsey. Police observed a bowl of JonBenet's favorite fruit, fresh pineapple (bits of which, we recall, were found in her upper small intestine), on a breakfast-room table. It bore Burke's fingerprints (and those of his mother). Possibly Burke had enticed his sister from her room and suggested some secret play in the labyrinthine basement, leading the way with a large flashlight that police observed before it later disappeared from the kitchen counter. Renowned pathologist Werner Spitz thought it could have been the murder weapon (Thomas with Davis 2000, 192, 239). Police photographed a dictionary on a coffee table in the first-floor study, opened and with the lower left page corner creased so as to point to the word *Incest* (Thomas with Davis 2000, 263). This suggests the Ramseys tried to see if the sexual explorations between their beauty-queen daughter (whom many felt was being sexualized by her mother) and their precocious son fit that label. It is worth mentioning that Burke and JonBenet occasionally slept in the other's bedroom—as acknowledged by Patsy Ramsey in her first interview with police (Gentile and Wright 2003, 91).

The perpetrator may have passed

out himself and then—finding JonBenet unresponsive—became alarmed. He may have first tried to revive her by shaking her (Wecht saw evidence of this from bruises to the brain's temporal lobes [Wecht and Bosworth 1998, 100]), then by poking her (with, say, the toy train track). Finally, in despair and rage he could have hit her with the flashlight. In time, he might be expected to run to his parents. The piercing scream heard by a neighbor—between midnight and two AM December 26—was probably not from a child, as the neighbor thought, but Patsy Ramsey, who was given to such outbursts (Thomas with Davis 2000, 29, 71–72), when she first saw her little girl dead.

Psychic Connection

If this hypothesis is correct, it helps explain why the case has gone unsolved for twenty years. It has been widely acknowledged as extremely difficult. But if one finds the explanation bizarre (Wecht knew many would find the sexual asphyxia aspect shocking), that is not so surprising after all. I have a saying, "An unusual case may have an equally unusual solution."

In any case, during the twenty years of mystery and controversy, we must ask, where were the psychics? Could not those who profess to help police solve crimes tell us what really happened to JonBenet Ramsey?

The fact is, psychics frequently tried to insinuate themselves into the Ramsey case. A lead detective on the case, Steve Thomas, tells us that—before politicization of the case and frustration with the Ramseys prompted him to resign—"a Beverly Hills psychic left multiple hours-long voice mail messages for me." This was only one aspect of an avalanche of "unsolicited theories, possible suspects, and hate mail." In addition, "Sketch artists offered everything from a Michael Jackson look-alike to 'the Fly' as the culprit," and "Internet groupies passed along their ideas" (Thomas with Davis 2000, 111, 330–341).

I was already closely following the Ramsey case when in 1998 my friend, the great entertainer and author Steve Allen, sent me "a quick note, while on the usual run." He mentioned "an alleged psychic," consulted in unsolved deaths "such as the JonBenet case," who had appeared on the previous day's (April 27, 1998) *LEEZA* (Leeza Gibbons's show). As Steve suggested, I obtained a copy of the program and learned it was a psychic I was quite familiar with, having been featured in my book, *Psychic Sleuths* (1994, 12, 42–59, 214, 238).

Her name was Dorothy Allison. From Nutley, New Jersey, she was a high-profile pretend psychic, with a string of failures to her credit, although one would think otherwise from her claims. Allison told Leeza's audience that JonBenet's parents were "absolutely not" involved and that the actual killer was a former Ramsey handyman. She said she saw "connections" to Germany and Georgia, the numbers 2-8-9, and the names "Martin" and "Irving"—the latter, she said, being "the one I think that did this" (the murder). Allison worked with a police artist to create a drawing of the alleged killer (Nickell 2004, 252–257).

Shrewd psychics use a number of tricks to give the illusion they have visionary powers. Some obviously research cases, then use their best guesses to say something believable. A technique called "retrofitting" (after-the-fact matching) is often employed: The psychic offers several vague "clues," trusting that *after the true facts are known* some may seem correct or they may be interpreted to fit, while those that do not are conveniently forgotten. Even sincere—but generally fantasy-prone—psychics can unintentionally fool themselves and others by saying whatever pops into their mind, since credulous people tend to count the hits and ignore (or favorably interpret) the misses.

None of Allison's "clues" seemed to be of any help to law enforcement. The Boulder police noted that no one outside the Ramsey family was likely to have been involved in the death of JonBenet. Years passed, and in 2006, a forty-one-year-old man named John Mark Karr gained much attention when, arrested in Thailand, he "confessed" he was JonBenet's long-sought killer. The credulous rushed to try to link Karr with the late Mrs. Allison's pronouncements and drawing, claiming the resemblance of the latter to Karr was impressive. In fact, it was anything but (Nickell 2006). Moreover, neither DNA nor handwriting—or anything else—linked Karr to the crime scene, and he could not be placed in Colorado on or about December 26, 1996 (Fisher 2016). There were other false confessions as well (Ramsey with Chapian 2012, 173–174).

Other psychics fared no better than Allison. Most adopted one of the prevailing theories. For example, online psychic Marie Saint Clair saw an intruder, likely "homeless or a drifter" as supposedly indicated by "his bare feet"—but for which there was no

evidence ("Can Psychics" 2016). One "consulting group," PSI TECH, used what they term "Technical Remote Viewing" (TRV), "a breakthrough mind technology that allows a trained operative to consistently obtain accurate intuitively derived information, on demand" ("PSI TECH" 2016). The technique resulted in psychic-sounding impressions presented with jargon ("base line data points"). Among the "conclusions" was that the "murderer" worked in "an industrial plant located in a generally NE to SE direction from the murder site" ("Can Psychics" 2016). Of course there was no intruder, so all this was worthless.

Still other psychics focused on the Ramseys. For instance, Elizabeth Joyce from Chalfont, Pennsylvania, claimed, "JonBenet Ramsey's mother's spurned lover killed the baby beauty queen as retribution for his rejection" ("Can Psychics" 2016). Again, Amy Venezia, a "psychic medium" who says she speaks with dead celebrities, claimed to receive spirit communication from JonBenet. Allegedly, Patsy was jealous of her daughter and was sexually abusing her, while some "secret cabal" was behind the child's "ritualistic" murder ("Did a Psychic" 2016).

We could continue, but perhaps this is enough to indicate the uselessness of psychics in the Ramsey case. The hypothesis I have presented—not an accusation but simply the most likely scenario provided by the best evidence—has led us where psychics never went. Hopefully, one day we shall know how close it is to the truth. Meanwhile, Ramsey family lawyer L. Lin Wood is suing—on behalf of Burke Ramsey—famed pathologist Werner Spitz (author of a major forensic textbook [Spitz 1993]). The $150 million defamation lawsuit stems from Spitz's participation on a CBS documentary (*Case* 2016) and other statements he was quoted as making (Stockman 2016).

Spitz advances Burke Ramsey as the killer and his parents as participants in a cover-up. My own hypothesis goes further, focusing on what must be seen as crucial: whether the blow to the head preceded or followed the garroting. If the latter, then the garrote was the probable unintentional cause of death. I think it unlikely the Ramseys added such a gruesome and unnecessary element to the corpse of their beloved child. If I am right, the death may not actually have been a murder after all, and the Ramseys only guilty of protecting their son. ■

Notes

1. The following were known to be missing from the house, in addition to the end piece of the paintbrush handle: the roll of black duct tape; a ransom-note practice page; and the presumed remainder of the white cord used in the bondage—all presumably removed as part of the cover-up (Douglas and Olshaker 2000, 73–74; *Killing* 2016).

2. I met with Gideon Epstein (then with the Bureau of Immigration and Naturalization) and Antonio Cantu (U.S. Secret Service) after they invited me for a VIP tour of their respective document laboratories, October 25, 1996, all of us having been involved in the case of Nazi war criminal John Demjanjuk.

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Joe Nickell, PhD, is a former investigator with a world-famous detective agency who has been consulted in homicide and questioned-document cases. Among his numerous books is *Crime Science: Methods of Forensic Detection*.

‘Psychic Detective’ Noreen Renier: The Grinch Who Stole Christmas from a Grieving Family

Newly obtained recordings provide a unique opportunity to assess the sessions of a genuine “psychic detective” police case.

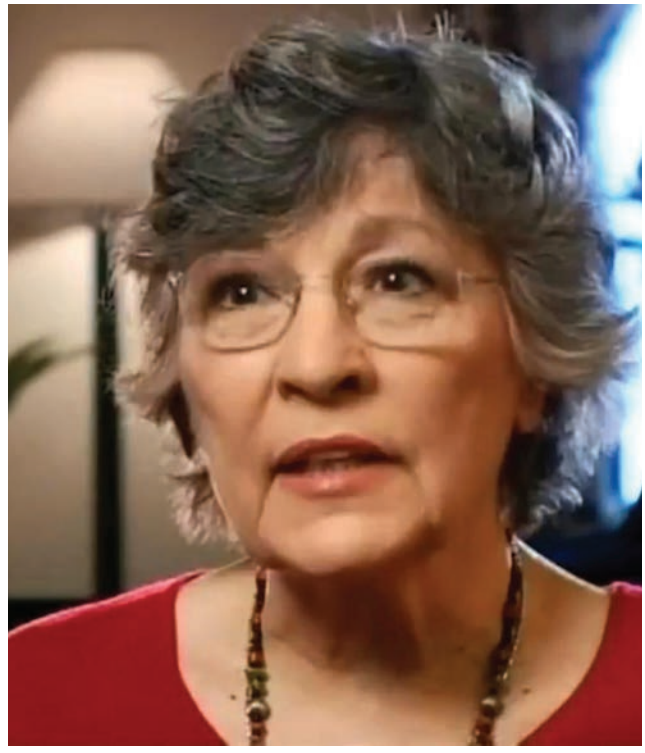
GARY P. POSNER

August 12, 1989, was to be a joyous day for nineteen-year-old Kimberly McAndrew, a college student cashiering for the summer at a Canadian Tire store in the heart of the Halifax, Nova Scotia, peninsula. It was her boyfriend’s birthday, and he, along with her sister Heather, were to pick her up from work at 5 PM and begin the celebration. But Kimberly’s boss allowed her to clock out at 4:20, and though she presumably headed home—about a fifteen minute walk away—she remains missing to this day.

Six years and numerous dead-ends later, in October 1995 the Halifax Regional Police hired famed “psychic detective” Noreen Renier in the hopes that her paranormal abilities, endorsed by such notables as legendary FBI Special Agent Robert Ressler (coiner of the term “serial killer”), might lend some needed direction to their efforts. And if the *number* of directions in which she led them is any measure, they got their money’s worth!

In August 2015, during the course of research for a series of articles about the many long-unsolved murder cases in his city, *Halifax Examiner* editor Tim Bousquet obtained from Renier audio recordings of her three sessions (conducted by phone from her home in Florida) with Halifax Police Constable David MacDonald and sent them to me for comment. The opportunity for the public to hear and evaluate such a collaboration in its entirety is extremely rare, and I have made the recordings available at gpposner.com/Renier-Kimberly.html. Since interested readers can listen for themselves, I will try to limit this discussion to the most salient highlights.

Renier’s specialty is “psychometry”—holding onto an item (having been mailed to her by the family or police) belonging to the missing person, from which she derives the ability to “become” that person. As she explains, “There will be times



Noreen Renier

I will be Noreen, so if you really want *Kimberly* to see something, you have to say, 'Now Kimberly, we want *you* to tell us.' … It'll be a mixture, and I'll probably have the bad guy in there too occasionally."

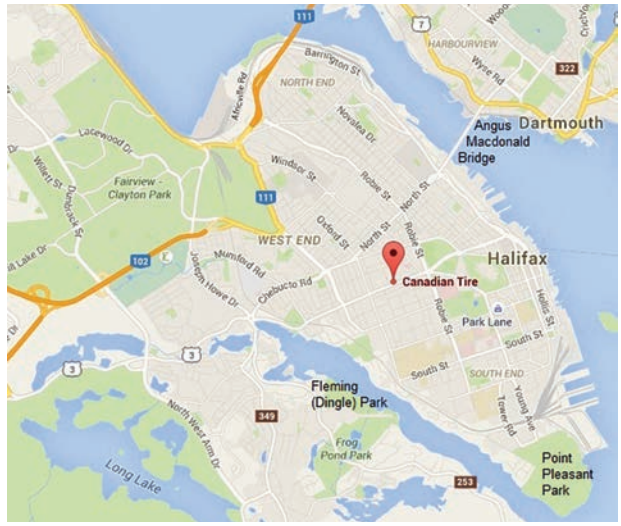
The first session, which lasts just over an hour, has Kimberly's sister Heather and their mother on the line (they don't participate in the next two) with Constable MacDonald. Renier soon makes "psychic" contact and offers news that everyone has been waiting six long years to hear: "I have Kimberly here. … She's going to show us pretty soon where she is." Yet matters quickly devolve into a protracted wild goose chase, starting at the very beginning with several serious stumbles. Kimberly (being channeled through Renier) declares, "I'm going to go out the south side of the building." But although that side does face the street, witnesses attest to her exiting the rear parking lot door, which is along the building's *north* side. And mere seconds later Renier tells us, "Her car is taken a short distance," though Kimberly did not drive to work that day.

Matters quickly devolve into a protracted wild goose chase, starting at the very beginning with several serious stumbles.

Yet no one seems disillusioned by these "psychic" insights, which the constable and the family must have known were errant, or by any of the claptrap to come—not even when mired in a mumbo-jumbo directional clue such as, "I'm seeing a clock. I'm seeing a center [in] which I want to put Kimberly. I would put where I left work, it's either at 5:30, or just a little bit after, I don't know. Seven o'clocks are backwards, so it's either 5:30 or almost 6, or just a little before 6:00, but I don't know what side it's on, I really don't. Is it 5:30, or 7, 6:30?" There are numerous (though fruitless) coherent clues, such as the "I want to go south, maybe southeast" one that ultimately leads to the first new search site. Perhaps Renier's radar is hampered by a shortcoming that we learn about in a later session when she is asked to look to the south on a map: "I don't know which [way] is south. I really don't do maps."

When Renier channels Kimberly long enough for her to speak to her mom for the first time since having disappeared, her topic of choice isn't what one might expect: "What are you doing to your hair? I don't know what you've done, but it's not the same [as] when I was there. I don't know—it's different." And Kimberly's next (and last) such soliloquy rings no truer: "You still have that picture up of me, don't you? [Mom: "Many pictures."] Yeah, well, that one I don't like. The one that was taken at school. I just never liked that thing; it looks so dirty. I don't like that one. I like the others, though. And it seems like there's new paint around there; I can smell some new paint."

Nor does Kimberly sound any more authentic when MacDonald asks her what her plans were when she headed out: "Well, I was going, it seems like it's either raining or it's wet, or whatever it is I feel wet around me. I don't know if I'm in water now or it was raining then. [Sorry, it sure wasn't.] But my plans, either it was just a little trip or a little getaway, or, I feel like it was planned, only I didn't get to the other end. I had something planned; there was something specific to do. I don't get there. I get waylaid." And when asked if she recognized anyone as she exited the store, Kimberly's answer is again reminiscent of Renier's own rhetorical style: "Yeah, I see a guy with a short name. He is slender. I feel more dark hair, maybe very thick, maybe some strong curl or wave in it. Would have a very strong accent, but not your Canadian accent. It's even a different accent to me, maybe a little bit more Slavic." Though maybe not—Renier will later divine that the sole abductor was likely Kimberly's "blood relative," before she ultimately decides that *an alleged witness's* story about *three "native Indian" (First Nations) strangers* is correct.



But the first session does include one impressive-sounding possible "hit": "I saw a 'Ken,' or it started with a 'K-E-N' … Now I don't know if this was Kimberly or who, but … my knee … it could be upper leg. … I hurt so much there." MacDonald reveals someone named Ken to have been the principal case investigator at the time and that he "has a very bad leg." But could Renier have obtained that information by other means in the interval between her hiring and the day of this session? And note that it was MacDonald—not Renier—who says that the lead detective was named Ken and has a bad leg. And had that clue not struck any chord with MacDonald or the family, Renier could have replied that maybe it was "K-I-M" that she saw, and that *her* leg got hurt during the abduction or murder.

Constable MacDonald tries several times to get Kimberly

to name her abductor, with (of course) no success. She and her channeler instead lead him through a maze of ambiguities, such as, "If there's a road or a street called 'S' there [to the southeast], something with an 'S' name," and "I'm at work. It's 4:20. I want to see [the] odometer. … It could be 7.2 or 72. I feel a 7 and a 2 very strongly. And it could be seven-two, seven-three, could be a longitude or latitude." And a moment later, "I've got a one-seven this time … maybe 1.7. It's by … a park or parkway or park something, Park Road, but there's something with a park involved in the area that she's at." This occurs about twenty-two minutes in, and Kimberly has still yet to simply, as advertised, tell them where she is.

The "psychic" takes a cruel turn after asking Heather if she writes down the details of her dreams about her sister. When the answer comes back "No," Renier tells her, "Well, I try to recall [my dreams] as much as I can because I think there're even clues in the dreams. [Kimberly] just finally gave up on you." But Heather apparently keeps her composure and even becomes the first to garner a seemingly solid clue, asking her sister if she is in a familiar place. Kimberly answers, "Yes … someplace popular. … We [the family] went there more for a holiday, I think, one time." And a bit later: "There's a well. There's a big body of water [but] I'm not there, I'm in the well." Renier suggests, "OK, let me go to the future and see when you find her. … I would say, if it's not this month it's next month. … I have no doubt that you'll find her." She adds (brags?), followed by two chuckles, "Some people have to wait three or four months, a year." She also predicts that when she channels Kimberly again, "It won't be hard for me to see who did it." I'm tempted to say "famous last words," but those are hardly her last!

The second search of the park had yielded nothing, and now a jailed convict in Halifax is claiming to have seen two associates murder and bury Kimberly.

Before the first session concludes, Renier mentions going over a bridge that "has an alphabet or numbers or something but not really a name." Though that clue wouldn't apply, based on the totality of Renier's others so far, we learn two weeks later, at the beginning of the second session, that MacDonald made Point Pleasant Park, which occupies nearly 200 acres at the southeast tip of the peninsula, his first search priority (see map). But he says they surveyed "all known wells and whatever and had no success." Yet Renier still sees the image of a "cylinder shape," and MacDonald presses Kimberly for confirmation that she is in that park. "Yes, I am. I'm there. You all maybe came within ten to twelve yards." But instead of hanging up at that point and marshalling a more thorough exploration of the park, he asks Kimberly to better describe that bridge. "The metal bridge is over … swift-running water. It is quite a ways down there. A lot of boaters, rafters." MacDonald: "Could it be the Angus L. Macdonald Bridge?" Kimberly answers, "Sure." But as Constable MacDonald then points out, "The only problem with that, Kimberly, is the Macdonald Bridge leaves Halifax and goes to … the city of Dartmouth." (But remember, Renier said the bridge doesn't "really [have] a name"!) Renier's comeback: "I could be seeing this in another stage of her life." But the only problem with that, Noreen, is that he was conversing with *Kimberly*, not you!

Kimberly also reveals that there is "some other stuff in here with me," to which Renier adds, "He's not just hiding a body; he's hiding a body and evidence. … And I think this is why we haven't found him yet." Discussion ensues about Point Pleasant Park's three points of entry, and Renier selects the one at the park's eastern border just north of Black Rock Beach. MacDonald is directed to enter through the gate "and then we'll hang a right. It might be two rights in a row." When he asks if "old Chain Rock Battery" means anything to her, the response is, "Yeah … on one side is water. Yes, yes, and it's got a very, brick, gray, that gray is there" (those were some earlier clues). They agree to check that part of the park next, even though it is at the far west end, and hanging a right upon entering that eastern gate would take you due *north*. Nonetheless, confidence abounds as Renier half-jokes, "If we find her, can I come up and say hi to you all? … And make plane reservations [for me]; that's how confident I am."

So why, one minute into yet *another* (the third and final) psychic session, does Renier advise MacDonald to "shove it all out the door" (referring to all the information she provided in the first two sessions) and "just sort of start with a fresh picture"? The second search of the park had yielded nothing, and now a jailed convict in Halifax is claiming to have seen two associates murder and bury Kimberly. MacDonald says that according to this source, "Not too far after … they cross the [Angus Macdonald] bridge … supposedly that's where she's murdered." (I can't help but wonder if MacDonald had leadingly suggested that particular bridge to his source like he had to "Kimberly.") Continuing, "And then they come back across the bridge to Halifax" before burying her in Fleming (sometimes called "Dingle") Park, which is "across the [water] from [the west end of] Point Pleasant Park." Renier wonders if maybe she had selected Point Pleasant "because of me touching it so much" (on some printed matter). But recall that it was not Renier, but the channeled Kimberly, who had earlier declared that she was there, just yards from where searchers had been looking. Renier can't keep her personas straight.

Yet Renier is skeptical of the jailbird's story: "I don't buy it. I just don't buy it." She instead recommends going "the opposite way from where he was showing you," and so they look northeastward again over the bridge into Dartmouth, after which there's "a right turn or right road that we would take," which MacDonald advises her would lead southward. Trying to fathom exactly "where [Kimberly] was put," Renier is reminded of her earlier "cylinder" clue, and now also perceives a "very deep" gulley. MacDonald tries to assist: "You're on the number 7 highway (heading southeast just over the bridge as per the map). Would this lead to this gulley that you're seeing?" Renier answers in the affirmative, and moments later, "I feel in the gulley. … I just feel [we will find her soon], before Christmas."

But recall that it was not Renier, but the channeled Kimberly, who had earlier declared that she was there, just yards from where searchers had been looking. Renier can't keep her personas straight.

But *where*? In this gulley across the bridge to the *east* of the Halifax peninsula? In a well within Point Pleasant Park, as "Kimberly" herself insists? Or where MacDonald will now again focus Renier's attention, across the water to the *west* of the peninsula, in the park fingered by his alleged witness? Upon viewing pictures of that park, Renier exclaims, "It's got brick! … It's got lots of things! Yes, yes, yes!" MacDonald tells her that his source "says that they dug a hole in the ground, very shallow, in that Dingle Park." But Renier again expresses distrust: "That's B.S., total B.S. … There's no way. … These guys aren't the ditch-digging type, OK? They didn't do that." But when she envisions herself "inside that park ... [t]here's the overhang. I can see the overhang." MacDonald asks if by "overhang" she is referring to "that gulley you were looking down on" a little while earlier. Renier immediately exclaims "Yes!" Except that in all the excitement, they must have forgotten that the gulley she envisioned Kimberly being tossed into was across the Macdonald Bridge in the *opposite direction*!

Yet Renier likes a particular area of this park where MacDonald says "there are two [manmade] ponds [and] this little stone bridge going over one of them." Did "Kimberly" mistake this pond for a well? And this tiny stone structure for the nearly mile-long "metal bridge" she had earlier identified? He further notes that "those ponds in August [the month in which Kim had disappeared] are basically dry, and they would look like a little depression in the ground … a little gulley." But though this is miles from the "very deep" gulley and also contradicts her "They didn't do that [digging]" remark, Renier agrees and further rationalizes that the "cylinder" shape could represent what Kimberly's body "was wrapped [in]" rather than a well, and she soon becomes so excited that "I'm sort of jumping up and down here! … I'm just going crazy because you know where it is! It's there! And he *was* right! … And the reason you can't find [the grave] is it's covered up with water!"

So, the wild goose having been chased down, all that remains in finding Kimberly's remains is deciding which of the two ponds to drain. "Do the one with the 'R' … I feel 'R' … That 'R' is going to be somewhere." (I suspect there could be more "rubbish" nearer to one than the other.) And as an afterthought, "Oh, I didn't tell you before; I got the name 'Jimmy.' … So is there anybody in our cast of characters named 'Jimmy'?" When MacDonald tells her that his source's name is "Jamie [or] James," Renier asks (though with the inflection of a declarative statement), "Oh, I didn't know that, did I?" MacDonald replies, "Yeah, actually you did" and Renier responds, "Oh, darn." But perhaps, MacDonald suggests, she can identify "these other two [First Nations] characters, like if you can maybe see something [else] about them that you can describe or Kimberly could describe." Renier says, "I would have to have the man's hair." (But she wouldn't need to get into *Jamie's* mind in order for *Kimberly* to describe them!) MacDonald even tells her that Jamie "told us who they are … where we can find them and everything. They're very well known to the police." But Renier doesn't even try, though as to motive she offers, "[Kimberly to them] was … blond … or the Anglo Saxon … enemy. I feel that they were drunk, on drugs, or whatever."

Whatever. It should be only a matter of days now anyway before the pond is drained and that hidden evidence—enough to put the perps away for decades—is recovered, along with the remains of young Kimberly McAndrew. And moments before they say their farewells, Renier assures MacDonald, "You'll, you'll, you'll, you'll find her before Christmas. … A nice Christmas present for everybody." But Christmas never arrived that year for the grieving McAndrew family, nor has it in the two decades since.

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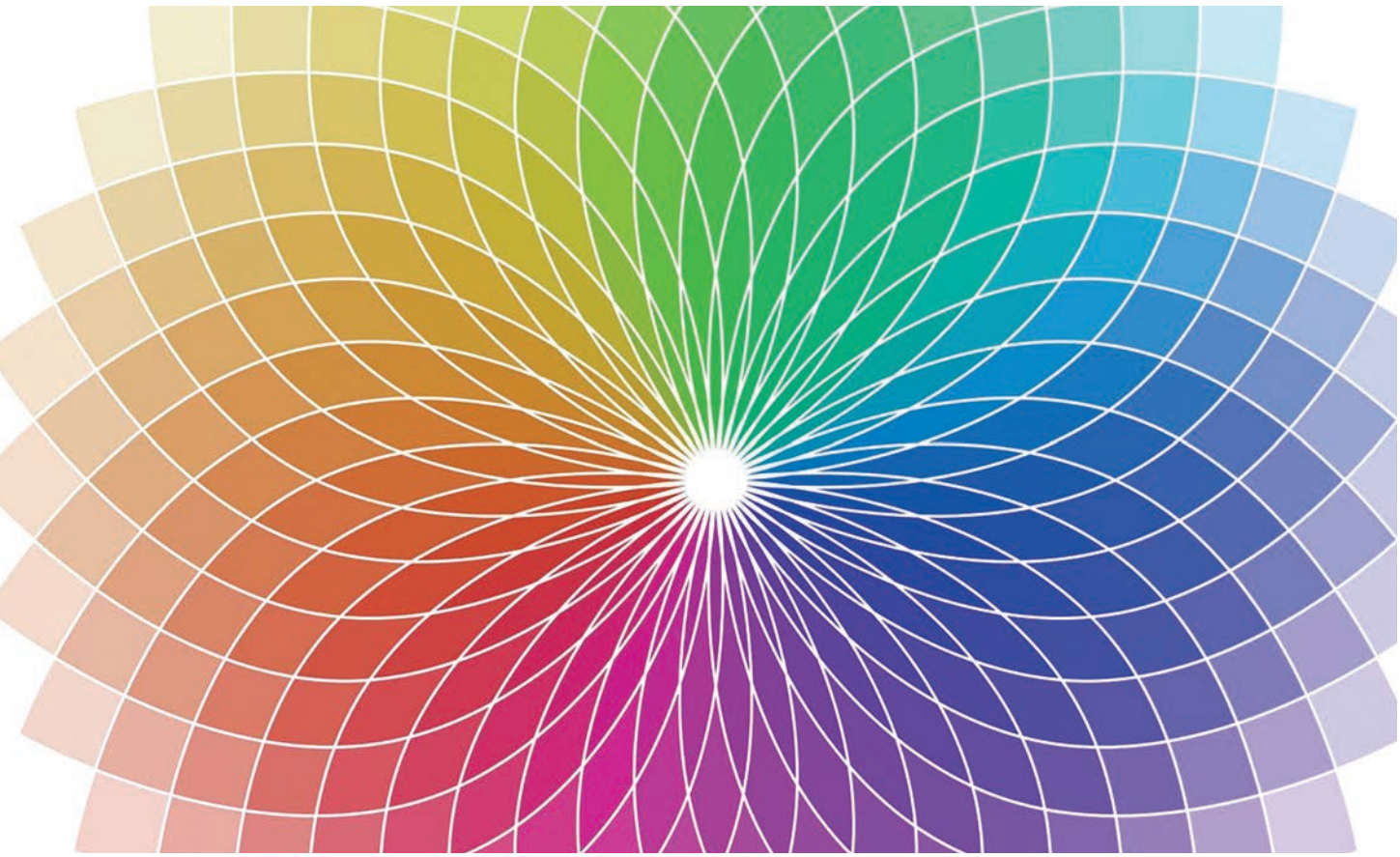
The Danger of Chromotherapy

Despite the lack of scientific evidence for its effectiveness and its use of esoteric theories to describe its mechanisms of action, chromotherapy has become popular. But is it safe?

SÉBASTIEN POINT



Chromotherapy, also known as color therapy, is a pseudomedicine based on a holistic approach and on a mixture of esoteric and scientific concepts. In a nutshell, it is the use of colored light applied on the skin or eyes to heal various health disorders, assuming some (scientifically undescribed) beneficial effects of color on body and mind. Traditionally, "color therapists" use white light sources to backlight colored filters. Nevertheless, driven by recent progress in solid-state lighting technologies, light-emitting diodes (LEDs) will probably become the most used light sources in chromotherapy. Some LED-based chromotherapy lamps are already available on the market. The main interest in LED lamps—in addition to their energy efficiency and long lifetime—is that they can provide various colors directly depending on the nature of the semiconductor inside without using any filter. Is the use of LEDs in chromotherapy without any risk?

Blue Light Hazard

In the last quarter of the twentieth century, the work of Ham, Mueller, and Sliney (Sliney et al. 1976; Ham and Mueller 1989) opened the way to the description of photochemical mechanisms of lesions on the retina during exposure to a blue light source. To prevent such damages, the International Commission on Non-Ionizing Radiation Protection (ICNIRP), in its "Guidelines on Limits of Exposure to Incoherent Visible and Infrared Radiation" (1989), defines a blue light action spectrum Bλ(λ) and exposure limits (expressed in radiance) that are used in *IEC 62471*, which is the standard when dealing with exposure to sources of broad spectrum incoherent optical radiations. The application of this standard is particularly justified for evaluating blue LED and white LED (also called White Phosphor Coated LED, or WPCLED, and made of a blue LED coated with phosphor), which combine high radiance and a blue-enhanced spectrum, as can be seen on Figure 1. In 2010, the French Agency for Food, Environmental and Occupational Health & Safety (ANSES) published a collective expert report making an update on the blue light risk associated with the use of commercially available blue and white LEDs (Rapport de l'ANSES 2010). The results showed that it was possible to buy white or blue LEDs lamps reaching the medium risk group (RG2), potentially harmful to the retina of the eye if not diverted in 0.25 seconds.

In Europe, the design standards of lighting fixtures now include photobiological safety requirements based on standard *IEC 62471* or its application report *IEC TR 62778*. Scientific work is still ongoing to better understand mechanisms of blue light–induced damages and to improve prevention (Jaadane et al. 2015; Behar-Cohen et al. 2011), but current exposure limits seem to manage the risk for general lighting well.

Metrology

As noted, to evaluate and limit exposure to blue light, the ICNIRP has defined an action spectrum Bλ(λ) and a maximum permissible exposure value to short wavelengths. The maximum of the blue action spectrum occurs between 435 and 445 nm, which is close to the blue peak of blue LEDs or WPCLEDs, as we can see in Figure 2. The maximum permissible exposure to these wavelengths is 10^6 J / (m^2.sr).

The exposure H_b can be expressed as the product of a quantity called blue light effective radiance L_b by the exposition duration T. The knowledge of L_b allows classifying the measured lamp in one of the four risk groups defined by *IEC 62471* by comparison with some limits. Limits for L_b values are made according to exposition duration values so that H_b stays below 10^6 J / (m^2.sr). Naturally, the risk group increases as the duration required to exceed the permissible exposure decreases (see Table 1).

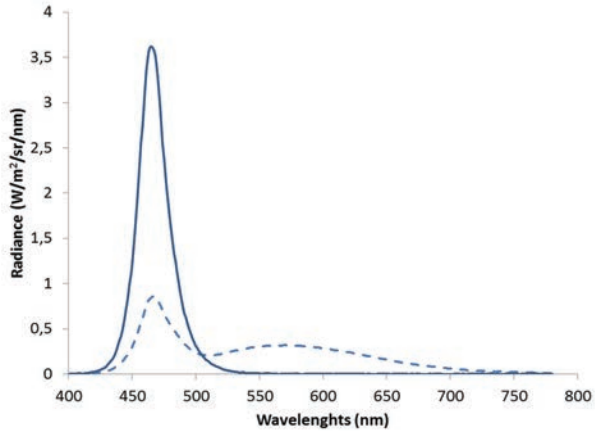


Figure 1: Spectrum of a blue LED (full line) and spectrum of the same LED after having superimposed a phosphor coat to produce white light (dotted line). Source: Sébastien Point.

When lamps or luminaires are measured and classified in RG2 and RG3, standard application report *IEC TR 62471-2* asks for some specific marking. That said, no specific marking is required for products classified in the no risk group (RG0) or low risk group (RG1), but that does not mean that the risk is absent in cases of inappropriate use, as for example in chromotherapy.

Chromotherapy Risks

Chromotherapy uses the (alleged) beneficial effects of color on the body and mind. There are generally said to be twelve "therapeutic" colors, but entering the keywords "chromotherapy" or "color therapy" in the bibliographic database of Alternative Therapies in Health and Medicine does not yield any medical research article that could help to understand their characteristics. Information available in the websites of color therapists does not provide a rigorous definition of the twelve colors claimed beneficial. However, this could have been easily done by giving a wavelength value for spectral color or by describing the spectral composition in the case of polychromatic radiation. Without this rigor in defining the colors, it seems very difficult to establish a repeatable protocol, as the physicist may have difficulty reproducing the color "lemon" (http://www.holistic-online.com/color/color_lemon.htm) or "strong pink" (http://unicorn-denmart.blog-

Table 1: Definition of risk groups depending on exposure duration (T) and Lb maximum values.

	RG0 (no risk group)	RG1 (low risk group)	RG2 (medium risk group)	RG3 (high risk group)
T (s)	10 000	100	0.25	<0.25
L_b max ($w/m^2/sr$)	<100	<10 000	<4 000 000	>4 000 000

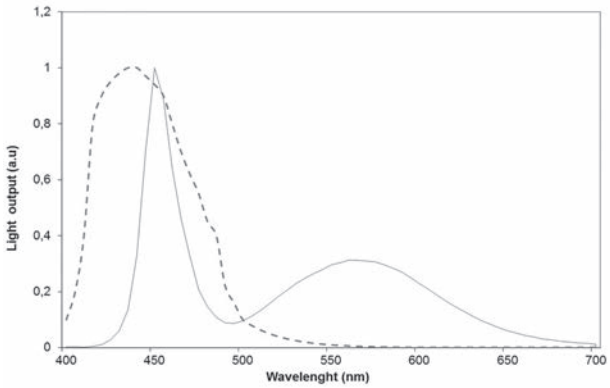


Figure 2: Spectrum of a WPCLED (full line) and action spectra $B\lambda(\lambda)$ (dotted line). Source: Sébastien Point.

CMP et Chromothérapie
Thérapie par Champ Magnétique et Chromothérapie
omothérapie, des processus biologiques de
nt naturellement activés, de la même façon
e thérapie par champ magnétique.
amené à activer son système immunitaire et à
ilibre. Dans le corps, la lumière est transformée
trochimique, qui est nécessaire aux processus
e et au système hormonal. Dans le cadre
ement s'effectue systémiquement à la fois par
peau ou uniquement par la peau, de façon
Figure 3.

Clearly, the color therapists do not trouble themselves with physics, scientific rigor, and evidence. Nevertheless, you can find many courses, seminars, and books, as well as many enthusiastic users and promoters. Indeed, as pseudomedicine, chromotherapy can be provided by a nonmedical professional in beauty or healthcare centers or even at home by individuals.

spot.com/2014/01/chromo-therapy-light-can-benefit-our.html). The lack of rigorous definition of colors and light sources disqualifies chromotherapy and is sufficient to refute the "scientific" character that some color therapists seek to fund their discipline.

Proponents usually associate these poorly defined colors with specific therapeutic effects on the body and on the mind. Of course, you could vainly search for a validated treatment protocol. Generally, the color is projected on the afflicted part of the subject, or on the eyes or even on the acupuncture points. The biological mechanisms for illuminated parts to see the color are not scientifically described, but therapists argue that "color therapy works on various energy points to help balance your body via the full spectrum of visible light, each color addressing a distinct need" (http://blog.sunlighten.com/chromotherapy-sauna-benefits-color-therapy-explained/).

In some variants of chromotherapy, colors are associated with "internal climatic energy" of the human body (heat, cold, moisture, dryness, wind) and would be capable of triggering a "climatic" opposite response from the body: for burns, for example, applying a red light (heat symbol) will supposedly cause an opposite response of the body (cold generation).

Clearly, the color therapists do not trouble themselves with physics, scientific rigor, and evidence. Nevertheless, you can find many courses, seminars, and books, as well as many enthusiastic users and promoters. Indeed, as pseudomedicine, chromotherapy can be provided by a nonmedical professional in beauty or healthcare centers or even at home by individuals.

As noted, light emitting diodes (LEDs) are already used in chromotherapy material and will probably become the primary light sources in coming years. Is it safe? Figure 3 shows an example of chromotherapy LED exposure as shown on the website of a chromotherapy lamp manufacturer. Notice that:

- The user's head is only few inches from the lamp, and there is no evidence that the head-lamp distance is under control.
- No eye protection is used.
- There is no evidence that exposure duration is under control.

There is naturally no evidence that chromotherapy is systematically or widely used in the way shown in Figure 3—but nor is there evidence it is used differently. This uncertainty raises a troubling question regarding the potential use of blue LEDs or WPCLEDs in a chromotherapy session. Even assuming that chromotherapy materials use only RG0 (no risk group) and RG1 (low risk group) LED bulbs, would the practice be safe so far without adapted eye protection and in conditions where distance and exposure duration are not under control? Lamps for chromotherapy cannot be considered as a source for general lighting service (GLS) as defined in *IEC 62471*. Lamps for chromotherapy must be seen as multipurpose lamps, as sunbed lamps, or as lamps for medical uses. As a consequence, L_b and risk groups for these kinds of lamps should be given for a 200 mm exposure distance. It is not unrealistic that users will place the light source only 200 mm from their eyes. In such a case, for an LED bulb whose L_b

would be between 100 and 10,000 W/m²/sr (range power of low risk group), maximum permissible exposure duration is between 100 seconds and 10,000 seconds, which covers many potential exposure situations. So permanent retinal damages from overexposure is possible if the user's eyes are voluntary exposed to a blue or white LED lamp of some thousands of W/m²/sr (RG1 without marking required) at a distance of 200 mm or less for a few minutes or more. With RG0 LED lamps, risk is lower but cannot be excluded either.

Conclusion

Although its promoters describe it as a rational scientific method, chromotherapy is a pseudomedicine, and consequently no real health benefits can be expected from it. On the other hand, there is some evidence that LEDs, even when classified in the no-risk or low-risk groups, can generate overexposure when critical parameters such as exposure distance and duration are not under control. We have good reason to believe that some users of LED-based chromotherapy material can not keep these parameters under control. For public safety, it is important that regulations or strong guidelines be put in place to supervise and control potentially dangerous practices such as chromotherapy.

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Sébastien Point is a French engineer and physicist who led some researches to develop mercury-free lamps and currently works in the lighting industry. He is a scientific rapporteur for blue light and vice president of the non-ionizing radiation section of the French radioprotection society, a member of French skeptics association AFIS and of the quarterly skeptic journal *Science & Pseudosciences.* His talks, in which he disassembles pseudoscientific practices, are available on the Internet.

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An Investigation of the Missing411 Conspiracy

In his "Missing411" series of books, author David Paulides claims that people are going missing from U.S. national parks under unusual circumstances and the National Park Service is obstructing attempts to investigate. What are the facts?

KYLE POLICH

People are going missing from America's national parks under mysterious circumstances, and the National Park Service is obstructing attempts to investigate these events. At least that's the claim made by author David Paulides in his "Missing411" series of books.

Paulides has classified over 1,440 missing persons cases under the Missing411 label. At its core, Missing411 is the vague claim that something unusual is occurring related to deaths and disappearances in national parks. The concept has been steeped in the milieu of conspiracy and the supernatural, as Paulides frequently appears on paranormal-oriented radio shows and podcasts to discuss it. A forthcoming documentary appears to be in the works as well. (I have been unable to ascertain the meaning of 411. I can only speculate that it's a slang synonym for "information," although "MissingInfo" isn't much better of a moniker.)

Interestingly, Paulides has consistently avoided providing any explanation for the cause of these supposedly mysterious disappearances. He's joined the ranks of those who are "just asking questions." One might assume Paulides, founder of the "North American Bigfoot Search" and author of the book *Tribal Bigfoot*, would arrive at a cryptozoological explanation. While this hasn't happened yet, it may, as Missing411 appears to be an evolving mythology.

When pressed for a causal explanation, Paulides has remained evasive. He sees his role as an investigator pointing to a problem, not a cause. Alien abduction, ghost involvement, faerie kidnappers, and transdimensional chupacabra can all be swapped in and out as possible explanations for this apparent mystery. The topic seems to be constructed with intentional ambiguity, promoting any nonscientific idea to fill in as a possible explanation.

Despite Paulides's appearances on *Coast to Coast AM*, talks at MUFON conferences, and interest in Bigfoot, proper skepticism requires us to entertain the Missing411 claims independently of his history and other beliefs. We should not dismiss this idea outright, in the same way we wouldn't dismiss Linus Pauling's legacy in chemistry because of his pseudoscientific beliefs about vitamin C.

Could it be that an underfunded and understaffed National Park Service and related police departments lack the tools and ingenuity to determine that an unidentified serial killer is at work in the parks? This is not outside the realm of possibility. Though Paulides has never put this particular claim forward, there is a nontrivial possibility he's inadvertently produced a dataset from which this conclusion could emerge. Of course, it does seem that Paulides leans toward more supernatural conclusions.

I was fascinated by the intrigue of the Missing411. Its *Blair Witch* vibe would have me eagerly in line on opening night of a Hollywood thriller with this premise. My curiosity was also piqued by the vagueness of the claim and the remote possibility that Paulides could be onto something legitimate—but with a practical explanation.

I embarked on a skeptical investigation using some of the approaches I've learned here in the pages of Skeptical Inquirer and in similar books on the subject. I determined that following "Hyman's Categorical Imperative"—do not try to explain something until you are sure there is something to be explained—was the best place to start.

Are the supposed Missing411 cases real cases or works of fiction? I used a random number generator to select several pages from *Missing411: Western United States & Canada* to conduct a detailed verification for the first case on each page. Every case I checked related to real events; Paulides is not making these disappearances up.

One case involved a hunter who never returned from his hunt. His car was found but his body was never recovered. A second case involved a hiker. Paulides mentions that "law enforcement officials have said they believe foul play was involved." As with any unexpected loss of life, both cases are tragedies. Yet both cases are banal and devoid of any apparently unusual qualities.

In another case, two stranded parents with known drug problems had a car breakdown during a snowstorm. Paulides reports the parents' remains were found scattered. I was unable to confirm the scattering, but I was able to confirm their infant child was never located.

The oldest victim in my audit involved a sixty-nine-year-old hiker climbing Mount Shasta, moving alone in wind conditions estimated at seventy miles per hour. Once he split off from his companions, he was never seen again.

I was finding these cases to be fairly mundane until I arrived at the hiker's disappearance. Following a deadpan factual reporting of the details, Paulides quotes a local person saying cryptically that "according to local legend, beings called Lemurians lived underneath Mount Shasta . . . maybe the Lemurians got Carl."

The text is decorated sparsely with this and other head-scratching nonsequiturs. For example, in the last case of my brief audit, a woman named Amy disappears while exercising. Her body was never recovered but her wristwatch was found in a river bed years later. Paulides points out that years after that, a woman named Ann disappeared from the same place. He felt the need to point out that "both of their names start with A, and their first names only had three letters." I can only presume Paulides is open to the possibility that some nefarious Batman villain is at work in this area. Beware the three-lettered killer!

It's moments like these—or his statement that "the fact that berries and berry bushes play a common role in many disappearances is quite intriguing"—sometimes make me wonder if this work isn't a satire. Could such a statement be a wink to the reader? Or could this be a viral marketing technique for an upcoming video game or feature film? While not implausible, I don't think that's the case.

I can only presume Paulides is open to the possibility that some nefarious Batman villain is at work in this area. Beware the three-lettered killer!

Everything about Paulides's work seems sincere. My interpretation is that he genuinely believes something mysterious is going on. He's factual in most of his reporting and generally respectful of the missing. Never is someone faulted for being in the wrong place at the wrong time. If anything, Paulides praises the missing for being in peak physical condition and deeply experienced with outdoors activities, making their disappearance by natural causes seemingly all the more unlikely.

Not all missing persons cases qualify as Missing411. Paulides describes the "pattern" of these cases. The pattern consists of some loose criteria such as canine rescue dogs not being able to pick up a scent. If true in a given case, it's evidence for labeling it as Missing411; if false, this contrary fact can be ignored.

Another optional criterion is victims being found deceased with their clothing removed—typically pants and shoes or boots. Paulides is quick to point out that voluntary removal of such items is totally irrational in most circumstances. I didn't know what to make of this detail until someone pointed me to the phenomenon of paradoxical undressing. This is a condition sometimes found in people experiencing hypothermia who feel irrationally hot and remove clothing to cool themselves. I presume Paulides, like me, must not have been aware of this fairly simple explanation.

Another optional criterion is cases where a deceased body is recovered but found a distance or elevation away from their last known whereabouts that "defies common sense." Yet Paulides doesn't present any *Twilight Zone*-esque cases of people showing up in bafflingly distant places. In truth, most of these supposedly common sense–defying distances are just a few miles.

Granted, terrain and conditions have a huge impact on lost hikers. I don't want to dismiss anything outright due to low magnitude, but I don't find anything exceptional in the cases I reviewed. The "strangest" case I recall was a hiker who was found three days later fourteen miles from his last known location. To me, as a hiker, this is not an implausible distance to cover in that time.

It would be interesting if Paulides would rank his cases by inexplicable distance. If I found nothing odd about the best example, it would be simple to dismiss his second best, and so on.

Failing to meet these and any of the other criteria of the Missing411 "pattern" does not disqualify a case from fitting in the category. In fact, actually being missing is not technically required! A minority of cases in the catalog involve missing people who were recovered alive. Curiously, these all seem to be young children. I suppose an adult, gone missing and found, can self-attest that their missing time was explained by ordinary circumstances. Children may not have the same developmental functions to coherently account for their whereabouts, thus leaving a gap to be filled with the possibility of something unusual.

With such imprecise criteria, it seems Paulides considers himself the only person fully qualified to identify a missing persons case as belonging to the Missing411 or not.

On the whole, I find no outstanding cases in my research of Missing411. There's a surprising absence of anything spooky. No one is found a decade later without having aged a day; a Missing411 victim hasn't appeared enigmatically on the opposite side of the world; no cryptic notes or cyphers appear in the books' pages. The cases are disappointingly typical of what one would expect from a missing persons case.

The proposed unusualness of these cases seems hardly greater than one would find for a rare and unplanned occurrence such as a disappearance.

But could there be a mystery in the aggregate of these cases? Perhaps in total they paint a grim picture. Unfortunately, Paulides does not explore this idea. The argument (such as it is) seems more of the form of "look at all these cases; even if one or two are explainable, they can't *all* be explainable." No matter how many half-truths one collects, they never sum to a whole truth. To be sure, within the Missing411 dataset are cases of unsolved foul play, kidnappings, private suicides, animal attacks, people looking to disappear and assume new identities, and other natural explanations.

Perhaps we might find room for unusual observations if we consider the frequency of these events. People disappear.

Of all the disappearances in a year, are a suspicious number of them coming from national parks? In truth that's a difficult statistic to analyze. People do disappear, and any disappeared person must have a last known location. However, that doesn't make every location on the planet equally probable for generating a missing person. I looked into this briefly and found that if anything, you're less likely to disappear from a national park than from a major city.

I'm willing to play along a bit. Let's assume a disproportionately high number of disappearances occur in national parks. What exactly is the responsibility of the National Park Service (NPS)?

Paulides has called the day-to-day operators of the parks "good people." He takes issue with the administration, finding them somewhere between incompetent and complicit. He's frustrated with their response to his FOIA requests and accuses them of obstructing his investigation. There are moments where it seems he's implicating the NPS in a conspiracy, but other times his perspective is softer. He claims, "It would be incorrect to state that the [NPS] had not cooperated with my efforts…. However, in some cases they were evasive." Yet elsewhere, Paulides is frustrated the NPS won't produce the documentation he seeks. He asserts, "I believe they do have the data, and that the data they possess would shock the average American citizen."

I have confirmed he made many FOIA requests, and some were denied. Apparently, to learn more, I would need to initiate an FOIA request for a list of the FOIA requests Paulides made. You can do that! I don't think I have much to learn, however. Paulides doesn't seem to lie about details. With multiple books under his belt, satisfying his requests might indeed be costly. If the NPS has been dismissive or evasive, that's not proof of anything mysterious.

I spoke with an NPS public affairs representative about the handling of missing person cases. Cases are entered into the National Law Enforcement Telecommunications System (NLETS). This is a federated data sharing system used by law enforcement nationwide. I await proof that any case has failed to be entered.

To be fair, it would not shock me if independent law enforcement organizations did not have the resources to extensively review the NLETS. If a suspicious pattern existed, it could plausibly go unnoticed. Of course, the burden of proof is on the claimant.

I got in touch with former ranger Andrea Lankford, author of *Ranger Confidential*. She brought to my attention that there exists some degree of controversy about the operation of the parks and the ranger system.

It's a broad topic, but I'll give some highlights. Rangers may be asked to wear too many hats without appropriate training. Some believe the parks are understaffed. There's a perspective that rangers are not equipped to handle some law enforcement activities that fall under their jurisdiction. Some people call for reform.

I've yet to reach a personal conclusion on these side topics. It is an intriguing discussion, but not one that has anything to do with making disappearances unusual. If the NPS is poorly structured, over-extended, incompetent, or corrupt, it would be unfortunate but not mysterious.

Surely Paulides knows of these claims. I am unaware if he's taken a position. Whether he agrees with criticisms of the ranger system or not, it's curious a comment is not more prominent in his research. I encountered no place where he weighs in.

Paulides is also displeased with the response of the media, stating, "news services sometimes temper the story or don't ask specific questions in regards to the scene." This hovers between accusations of conspiracy or incompetence. It's a claim made broadly without any specific evidence. What specific evidence are the news media failing to ask about and the NPS trying to silence?

Of all the disappearances in a year, are a suspicious number of them coming from national parks?… I looked into this briefly and found that if anything, you're less likely to disappear from a national park than from a major city.

I've exhausted my exploration for anything genuinely unusual. After careful review, to me, not a single case stands out nor do the frequencies involved seem outside of expectations.

The lack of any specific claim affords this idea the elasticity to be unfalsifiable, and its sinister veneer makes it attractive to the conspiracy-minded. From the way in which I've observed it proliferate through the paranormal media, I suspect Missing411 will remain a curio shelf theory for some time to come. When any missing persons case comes up, believers may be reminded of it, giving it a small injection of life in their cultural consciousness.

For me, as someone who visited his first national park (Yosemite) last year, I'm grateful we have these national treasures. I look forward to visiting many more with only the most prosaic of concerns any responsible hiker or camper should have.

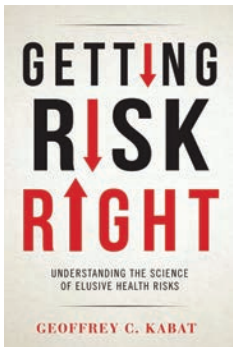
Kyle Polich is a data science consultant and founder of DataSkeptic.com, which explores the skeptical perspective on machine learning, artificial intelligence, statistics, and all things data related.

Why We Often Get Risks Wrong

TERENCE HINES

Geoffrey Kabat devoted his previous book, *Hyping Health Risks: Environmental Hazards in Daily Life and the Science of Epidemiology* (Columbia University Press 2008, reviewed in the July/August 2009 SI) to debunking overblown claims of risks of various environmental agents such as environmental causes of breast cancer on Long Island and radon and electromagnetic fields as causative agents in cancer. In his new book, Kabat goes beyond simple debunking and sets himself a much more ambitious task: "Two questions at the heart of this book are, first, how is it that extraordinary progress is made in solving certain problems, whereas in other areas little progress is made, and, second, why do instances of progress get so little attention, while those issues that gain attention often tend to be scientifically questionable?" (p. 27).

In the first three chapters, Kabat writes about how investigations of claimed risks sometimes get it right and uncover the actual causes of real risks versus investigations of non-risks that end up causing much unneeded anxiety and wasting large sums of research funds and researchers' time and effort. The last four chapters are case studies of specific investigations. Two of these investigations resulted, through careful and arduous medical detective work, in uncovering the real causes of a very puzzling disease in one case and a type of cancer in the other. The other two case studies are of investigations of environmental agents—cell phones and endocrine disruptors—that went badly off the rails and continue to unduly alarm the public and consume research time and money that could be much better used studying actual risks.



***Getting Risk Right: Understanding the Science of Elusive Health Risks.* By Geoffrey C. Kabat.** Columbia University Press, New York, 2016. ISBN 9 780231 166461. 272 pp. Hardcover, $35.00.

The book starts with a brief introductory chapter, "The Illusion of Validity and the Power of 'Negative Thinking.'" The second chapter, "The Splendors and Miseries of Associations," begins with a discussion of basic concepts in epidemiology. It emphasizes the complexity of teasing apart causation when causation is a complex network of interacting variables. This could have been a bit clearer in places. For example, saying that "If two variables are correlated, as one increases, the other increases" (p. 14) ignores the existence of negative correlations. The chapter highlights the work of John Ioannidis, whose 2005 paper "Why Most Published Research Findings are False" (*PLoS Medicine* 2005, 2, e124) caused much controversy when it appeared. The paper applied to medical research, not to other areas of scientific studies. The paper was often thought to be an attack on biomedical research in general, arguing that medical research really couldn't contribute to distinguishing between what was or was not risky or beneficial.

In actuality, Ioannidis's paper was highly critical of the ease with which sloppy research was published in even fairly prestigious medical journals. This problem is most evident, in the context of Kabat's book, in the ease with which papers were, and still are, published claiming that substance x has some sort of harmful environmental effects—sometimes, to some people, somewhere. This creates the "toxic terror de jour" type of reporting in the popular media that is so common. Kabat and Ioannidis argue that different scientific disciplines within biomedicine have very different levels of tolerance for bad research. Studies of the genetic contributions to disease have "become extremely rigorous owing to agreed-on standards for large populations and the requirement for replication" (p. 24). Epidemiology, on the other hand, is plagued with hordes of small studies reporting "it-might-maybe" be dangerous sorts of results with relatively small samples and poor study design and analyses. This, it seems to me, is due to journal editors' far too lax criteria for accepting studies for publication.

An excellent example of such lax publication standards is a study that appeared while I was composing this review. D. Leslie et al. published "Temporal Association of Certain Neuropsychiatric Disorders Following Vaccination of Children and Adolescents: A Case-Control Study" in *Frontiers in*

Psychiatry: Child and Adolescent Psychiatry (2017, 00003). This study looked at the risk of seven different psychiatric disorders. Autism was not included, although Robert F. Kennedy, the well known autism crank, has been singing the praises of this study as evidence for a vaccine-autism link. Presumably, as controls, the risk of broken bones and open wounds were also included. Seven different vaccination types were examined, each at three different times post-vaccination. This resulted in a grand total of 189 computed risk or hazard ratios (HRs). Sure enough, some of these comparisons resulted in HRs of greater than one, presumably indicative of a risk. Of the 148 HRs for the different psychiatric disorders, forty-one were significant. Of these, thirty-one were above one. The remaining ten were below one, suggesting that vaccines protected against a particular disorder. There were also a few (eleven to be exact) significant HRs in the results for broken bones and open wounds. Parents the world over will be happy to learn that vaccination against varicella protects, at three months, against broken bones. No attempt was made in this study to correct the significance levels of the HRs for the number of comparisons made. Had this paper been handed in to me when I taught an introductory statistics class, it would have received a failing grade. And yet it got through the editorial process at a semi-respectable journal and was published.

In the third chapter, "When Risk Goes Viral," Kabat discusses the reasons that studies reporting risks that may not be real, or are extremely small, are over-represented in the medical literature and then in the popular media. One obvious reason is that risks sell. They sell both newspapers and "panic de jour" reporting on TV. But now-you-see-it-now-you-don't risks also attract funding for further research. Even if an initial report shows a minimal risk in a poorly designed study, this is an opportunity for the authors and others to get funding to further study by arguing that the risk(s) might be real and thus deserve more research to really find out, once and for all, whether the risk is real. In this context, Kabat quotes UC Irvine researcher Robert Phalen (p. 43): "It benefits us [researchers] personally to have the public be afraid, even if these risks are trivial." When additional studies of the probably illusory risk don't absolutely, totally, prove the risk isn't real, well, that's just a reason for even more funding to track down whatever variable might be responsible. Thus, some proponents of the vaccine-autism link suggest that there is a special group of autistics for which there is a link, but the link may not be found for all autistics. This is sort of like saying that the link exists only for those born on an odd numbered Monday in the third week of a month without an "r" in its name.

Had this paper been handed in to me when I taught an introductory statistics class, it would have received a failing grade.

Kabat, again summarizing Ioannidis's work, notes that initial reports of risks tend to have follow-up studies that report much lower risks, if any at all. The same is true of initial reports of the effectiveness of questionable therapeutic interventions. The early reports seem hopeful, even dramatic, as was seen in the eruption of enthusiasm for facilitated communication. But then, as more studies are done with better design and controls, the initial effects fade away to either nothing or to a much more modest level. This is very reminiscent of the history of studies in parapsychology. A new paradigm to study the phenomenon is developed and, gee whiz, the first studies look great. But then results fade back to chance as better studies are done. And a few years later yet another flash-in-the-pan method is trotted out and touted as once-and-for-all finally proving that ESP is real … until it, too, withers away.

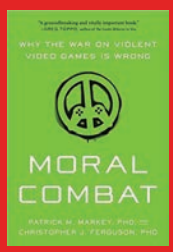
Other factors leading to continued study and hand-wringing about nonexistent or trivial risks is that humans are much more likely to be afraid of things they don't understand and can't control. This nicely explains the fear that power lines caused cancer back in the 1980s, a fear that has certainly not gone away even now. Related to this is another psychological factor—what Kabat terms the "availability cascade." This is a version of the availability heuristic in which people make poor judgments about the likelihood of some event because it is easier to recall examples of that event rather than some other event. Thus people judge traveling by commercial airline as more dangerous than travel by car when just the reverse is the case. This happens because it is easier to call to memory examples of terrible airline disasters than the ninety or so people who die each and every day on America's highways. As applied to public perception of environmental risks, Kabat cites the case of Love Canal near Buffalo, New York. This was said to be a neighborhood in which the residents were exposed to extraordinarily high levels of dangerous industrial pollution. But "only later, after years of more careful study by many scientists and agencies, did it turn out that, in fact, there was no evidence of any abnormal exposure among residents or any ill effects" (p. 54). And yet "Love Canal" is still a catchphrase for horrible environmental pollution. Kabat nicely summarizes (p. 55) why so much questionable research on risks is done and published: "Science that deals with factors that affect our health takes place in a different context from other fields of science. This is because we are all eager for tangible progress in preventing and curing disease." This leads to an emphasis on flashy, if shallow, research that may be of little use in actually improving public health.

In the next four chapters, Kabat focuses on four specific areas of research that serve as case studies for the distinctions he has made previously. Chapter 4 is titled "Do Cell Phones Cause Brain Cancer?" The answer is no; for anyone wishing for an excellent review and discussion of the history of the claim that

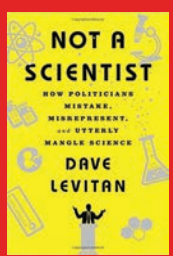
[NEW AND NOTABLE

Listing does not preclude future review.

EXOPLANETS: Diamond Worlds, Super Earths, Pulsar Planets, and the Search for Life Beyond Our Solar System. Michael Summers and James Trefil. This isn't your grandfather's galaxy (the theme of this book's first chapter), and Summers (an astronomer) and Trefil (a physicist and prolific author) here give us an up-to-date look at one of the liveliest and most exciting set of topics in modern science. New discoveries of planets beyond our solar system come almost every day. The authors give insights, discuss the challenges and issues, and argue that the richness and complexity of the worlds we are now finding require we rethink our place in the universe, because it is stranger and far more wondrous than we could have imagined. Smithsonian Books, 2017, 218 pp., $29.95.



MORAL COMBAT: Why the War on Violent Video Games Is Wrong. Patrick Markey and Christopher Ferguson. The authors, both psychologists, tackle the oft-repeated canard that violent video games foment real-life violence. Tracing American social concerns about children's violent entertainment back nearly a century, the book offers a close and up-to-date look at the issue. Their conclusion: The fear isn't supported by the evidence. In reality, most well-adjusted children and teenagers play violent video games, all without ever exhibiting violent behavior in real life—and sales of violent games correspond to *decreased* rates of violent crime. A welcome skeptical antidote to alarmist news media stories and political concerns. BenBella Books, 2017, 246 pp., $16.95.



NOT A SCIENTIST: How Politicians Mistake, Misrepresent, and Utterly Mangle Science. Dave Levitan. When you hear a politician start a sentence with "I'm not a scientist, but. . . ." you can guess that what comes next may be the stuff chronicled in this timely book. As the author says, the phrase "is a dodge, a bit of down-home hucksterism designed to marginalize those eggheads over there who actually *are* scientists as somehow out of touch or silly." Levitan, a Philadelphia science journalist, groups politicians' rhetorical and logical errors into clear types and helps you cut through the misinformation. His chapter topics say it all: Oversimplification, Cherry-Pick, Butter-Up and Undercut, Demonize, Blame the Blogger, Ridicule and Dismiss, Literal Nitpick, Credit Snatch, Certain Uncertainty, Blind Eye to Follow-Up, Lost in Translation, and Straight-Up Fabrication. "Getting science wrong has a whole host of consequences," notes Levitan. W.W. Norton, 2017, 256 pp., $15.95.

cell phones cause cancer and the nature of the research used to argue for that claim, this chapter alone is worth the price of the book.

Chapter 5, "Hormonal Confusion. The Contested Science of Endocrine Disruption," does for this controversy what the previous one did for cell phones. Most people have heard the claims that the so-called endocrine disruptors, synthetic estrogens, chemicals found in many plastics and pesticides, were having deleterious effects on people, especially children. It was interesting to discover in this chapter that these chemicals are dramatically less hormonally active than many naturally occurring substances. For example, natural substances found in cabbages are about 10,000 times more "estrogen equivalent" than those found in food "contaminated" by organochloride type pesticides. Again, this chapter is an excellent review of this area of research. Kabat concludes that the controversy over the safety of trace levels of these chemicals is likely to continue, driven by the factors noted above that support continued expensive searches for wild geese that were probably not there in the first place. Continued research on this issue will result in spending much-needed funds that could be much more productively used to investigate real, and solvable, health problems.

This chapter alone is worth the price of the book.

Chapters 6 and 7 focus on two just such real health risks and the researchers who pursued the answers, solved the mysteries, and saved many lives in the process. Chapter 6 starts in Brussels in the early 1990s with an outbreak of a mysterious and very serious kidney disease. The story leads from there through Serbia, Bosnia, and Croatia and then into China. I'll say no more for fear of spoiling the ending of the fascinating and very well-told medical detective story. Chapter 7 is also an international medical detective story. Here the issue is the relationship between viruses and cancer. Suffice it to say that the name Burkitt plays a large role, and much of the action takes place in Africa. These two chapters are tributes to dedicated medical researchers who spent much of their time out of the glare of publicity, doggedly plugging along trying to find the answers to real medical problems.

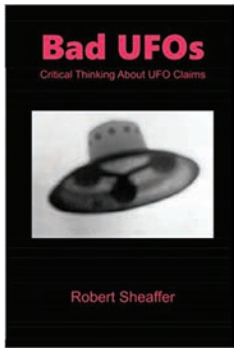
Kabat ends this excellent and informative book by calling for making better distinctions between issues that should receive attention and funding and those that should not: "There are real problems and there are false problems, that is, problems that, to the best of our knowledge, are not problems at all. Vaccines, genetically modified crops and foods, and cell phones are not threats to our well-being. We need to get better at distinguishing false problems from real problems" (p. 177).

I noted at the start of this review that Kabat set himself two goals for *Getting Risk Right*. He more than accomplishes both goals. ■

Terence Hines is professor of psychology at Pace University and author of *Pseudoscience and the Paranormal*.

A Good Analysis of Bad UFO Information

BENJAMIN RADFORD

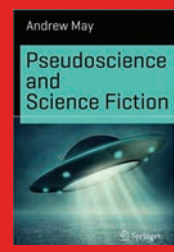


Bad UFOs: Critical Thinking About UFO Claims. **By Robert Sheaffer.** CreateSpace Independent Publishing, 2016. ISBN: 978-1519260840. 292 pp. Softcover, $18.95; Kindle, $8.95.

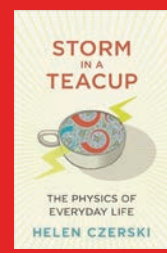
Robert Sheaffer is one of the—if not *the*—world's top experts on the subject of unidentified flying objects and claims of extraterrestrials, and he shares that knowledge in his new book *Bad UFOs*. A tireless gadfly to generations of UFO promoters too numerous to count, Sheaffer is author of *UFO Sightings* (published in 1998 by Prometheus Books) and until recently a regular columnist for this magazine. There are perhaps more in-depth scholars of claims of specific aspects of UFO reports, but Sheaffer is in a league of his own when it comes to encyclopedic knowledge of a surprisingly diverse topic.

Over the course of ten chapters and nearly 300 pages, Sheaffer covers an astonishing variety of claims, including the so-called "mystery missile" seen off the California coast in 2010; the Belgian UFO flap that author Leslie Kean unwisely endorsed; a plethora of UFO videos (debunked by Sheaffer, Mick West, and others); Steve Greer's UFO crusade, doomsdays, and much more. Though many "classic" and high profile reports and sightings are decades old (stale, widely debunked stories by Travis Walton, Whitley Strieber, Betty and Barney Hill, and so on), it's important to remember that UFOs remain the subject of discussion to this day. Though UFO reports have lost some of their profile (many UFO videos are widely debunked online within hours or days), new ones still surface, and Sheaffer is often on the front lines of analyzing them.

One of the most important chapters—and unfortunately one of the shortest—is the final, titled "UFO Skeptics Are from Mars, UFO Proponents Are from Venus." This celestial reference plays on a popular—if somewhat pseudoscientific—relationship book title, and it really is true that skeptics and believers approach evidence in different ways and through different prisms, and nowhere is that more obvious than in the field of UFOs. Even when UFO proponents' outlandish claims have been definitively debunked (for example in the Roswell slides case; see Sheaffer's "The 'Roswell Slides' Fiasco: UFOlogy's Biggest Black Eye," SI, September/October 2015), they rarely acknowledge their mistakes or demonstrate a sincere resolve to avoid them in the future. This problem plagues many areas of the "unexplained" but is particularly



PSEUDOSCIENCE AND SCIENCE FICTION. Andrew May. Astrophysicist May examines the links between pseudoscience and science fiction (SF) in his new book. SF authors are often inspired by pseudoscientific ideas for their stories, precisely because they are entertaining and "sciencey." Other times pseudoscience proponents and cranks borrow heavily from science fiction stories and elements, for much the same reason. May covers a surprisingly varied range of topics in just under 200 pages, including Charles Fort's influence on science fiction, "time slips," the Bermuda Triangle, ESP, Wilhelm Reich, conspiracy theories, Philip K. Dick's paranoia, Tesla, ancient astronauts, and much more. The book, part of a series titled "Science and Fiction," is illustrated with SF magazine covers, many from the pulp era. An interesting and informative overview of how science fiction, pop culture, and pseudoscience influence each other—and the public. Springer, 2017, 182 pp. Softcover, $19.05; Kindle, $9.99.



STORM IN A TEACUP: The Physics of Everyday Life. Helen Czerski. There can be a bit of snobbery about science found in kitchens and gardens and everyday life, Czerski laments, but as she says, "the same physics applies everywhere." This impassioned physicist (University College London) and BBC science communicator loves physics, and she proceeds to find physics lessons everywhere around us. Each chapter begins with something small we can see or discover ourselves, but by the end, "we'll see the same patterns explaining some of the most important science and technology of our time." W.W. Norton, 2017, 275 pp., $26.95.

WOULD YOU BELIEVE IT? Mysterious Tales from People You'd Least Expect. Selected and edited by Karen Stollznow. James Randi, Banachek, Ray Hyman, Eugenie Scott, Susan Blackmore, Chris French, Joe Nickell, Massimo Polidoro, James Alcock, Robert Sheaffer, James Underdown, Kenneth Feder, Lynne Kelley, and other skeptics, scientists, and humanists contributed to this surprising new book. Stollznow, a linguist, writer, and CSI fellow, asked them to share their "strangest, spookiest experiences, in their own words." The experiences seemed paranormal at first. Most often the authors found natural explanations. Deborah Hyde's essay on her out-of-body experiences and Daniel Prothero's take on Area 51, both demystified, are alone worth the book's price. CreateSpace, 2017, 247 pp. Softcover, $12.95; e-book, $9.95.

—Kendrick Frazier and Benjamin Radford

common in UFOlogy.

Bad UFOs is especially useful for those who want to stay up to date on UFOs and associated claims. This is crucial because "mysterious" UFO reports may be conclusively solved years (or even decades) after they occur, for example through hoaxer confessions, improved techniques for analyzing photos and videos, declassified information, and so on. It is rare for books to be updated with the new information, and updates to UFO proponent books (the vast bulk of publications on the topic) are made slowly and grudgingly (if at all). Sheaffer performs a huge—and largely unappreciated—public service in his recently retired SI "Psychic Vibrations" column, in *Bad UFOs*, and on his blog (at www.debunker.com) of keeping his audience current on old and new claims.

There are a few minor problems and oddities in the book, mostly related to its formatting. Some words are boldfaced for no clear reason, for example, and the book's origin as a series of columns, articles, and blogs results in a slightly disjointed tone. Though the book has an index and a general reference section, the lack of specific in-text references and citations somewhat thwarts the book's usability for readers who want to find out more information or check original sources. These minor quibbles don't detract from the world-class wealth of knowledge and expertise found in *Bad UFOs*, and it's essential reading for anyone who wants a skeptical analysis of the past few decades of UFO research and news stories. ■

Benjamin Radford is deputy editor of the Skeptical Inquirer and author or co-author of ten books.

The Bigfoot Obsession

JOE NICKELL

With Joe Gisondi's *Monster Trek: The Obsessive Search for Bigfoot*, the subtitle says it all. Gisondi, an outsider, traveled with Bigfooters—those credulous folk motivated to search for the fabled creature despite zero scientific evidence for its existence. At times, he sounds like a skeptic: "How could creatures presumed to be so large remain so elusive?" (77). At other times, he seems a believer: ". . . I felt something watching me" (37). He is, in fact, a journalist trying to be objective and show both sides: "As always I straddle the world of what could be and what is" (42).

Monster Trek: The Obsessive Search for Bigfoot. By Joe Gisondi. Lincoln: University of Nebraska Press, 2016. ISBN 978-0-8032-4994-3. 278 pp. Softcover, $18.95.

Gisondi accompanied searchers to eight alleged Bigfoot hot spots, including Florida swampland (where I too have trekked) and eastern Kentucky (where I grew up, spending an immense amount of time hiking, camping, and hunting, while totally unaware of the man-beast). Gisondi did not make it to Bluff Creek, California, where in 1967 Roger Patterson filmed the Holy Grail sighting of Bigfoot—or Bigsuit, a gorilla outfit purchased from costumer Phil Morris, modified by Patterson, and worn by his acquaintance Bob Heironimus.

On the trips, Gisondi learned that Bigfooters go in search of the creature for a variety of reasons: some are looking for adventure (9); many hope to confirm their prior faith (62); and, among other reasons, some Bigfooters simply enjoy the camaraderie or, lacking that, "the solitude of the woods" (265). For some, it's an escape from personal troubles (114).

Although most are not scientists (13), Bigfooters sport lots of equipment. Ironically inspired by ghost hunters—who have likewise failed to find their quarry—they are increasingly hunting at night using thermal cameras, night-vision goggles, and the like, as well as standard cameras and recorders. During his first expedition, Gisondi used a thermal imager to spot a Bigfoot kneeling on one leg, but he now wonders "whether I actually saw something that I wanted to see, as I do sometimes when I look up into the clouds" (xviii). One searcher even takes random snapshots of woods and scrutinizes them

later. Inevitably, concludes Gisondi (referring again to the pictures-in-clouds phenomenon), "he'll see what others cannot" (214).

In addition to the hopefuls are those Gisondi feels are largely seeking notoriety and money. One is Matt Moneymaker, creator of Bigfoot Field Researchers Organization (BFRO) and host of Animal Planet's long-running *Finding Bigfoot*. (Bigfoot is never found of course, despite constant hype and the urgent refrain, "Did you hear that?") "Moneymaker" is not his real last name and "may have been chosen to flaunt his success" (39). He is suspected of creating "sounds and stories" to encourage more people to pay to join his expeditions (54). Another is Tom Biscardi—whom Moneymaker calls a "bullshit artist" and "sham" (40). (Having been on a search with Biscardi, a known hoaxer [see my *Tracking the Man-Beasts*, 2011, 79–82, 90], I can't disagree.) Gisondi also passes on accusations of others' dishonorable activity (e.g., 140, 219, 235, 262).

Monster Trek also provides much evidence for what I have named "the Bigfoot bear"—any bear standing or walking upright, North America's greatest Bigfoot lookalike. For example, one woman using a thermal camera claimed she watched a Bigfoot for over three hours: "The creature stood up, hunched down, crouched, moved side to side. It got on all fours[!]." She added, "I saw its long arms and short legs" (!) (115). But another admits of many sightings, "Afterward, you think, 'maybe it was a bear'" (35). Gisondi (perhaps unintentionally) adds frequent reminders that Bigfoot is typically found in bear country engaging in bearlike activity (e.g., 133, 139, 152, 207, 226–227).

Monster Trek is a reasonably balanced introduction to the "obsessive" search for the elusive creature. Believers will resent its considerable skepticism, and some skeptics will be annoyed by its sympathy toward believers. As for me—a skeptical cryptozoologist who would like to believe but who knows too much to succumb—I enjoyed this inside look by an outsider. ■

Joe Nickell, PhD, is CSI's senior research fellow. A skeptical cryptozoologist, he is author of numerous books, including *Tracking the Man-Beasts*.

[LETTERS TO THE EDITOR

Enthusiastic Response

Your March/April 2017 issue has provoked me to make an enthusiastic response. I'm a longtime subscriber since the early '80s. I had seen your journal mentioned in an article and was very curious. I actually had to write to the publisher to get a subscription.

First, Lindsay's "Why Skepticism?" spoke to my own bias about items in SI. I, too, thought SI spent too much time on the "soft issues." Lindsay's article has led me to see that the strength of CSICOP is in its ability to attack irrational thinking at all levels of sophistication.

The articles by Tavris and Aronson and by Pigliucci are particularly timely and relevant. And I must say that SI has been publishing more on how and why we think, and that is good. One of my favorite books of the last few years is Kahneman's *Thinking, Fast and Slow*, which is very relevant to skeptics' thinking. Pigliucci's article, in particular, is relevant, I think, to dealings with the religious person. To the religious person there is virtue in belief. This is a quality that often gets lost in skeptics' responses.

And finally, a comment on a letter to the editor: Parenthetically, let me say that I find the letters to the editor and their responses are often as informative as the relevant articles. The letter from the Episcopal priest probably expresses a common fear of non-skeptics who may want to participate in dialogues about controversial topics. I am not sure to what extent her fears are justified, and I think Radford's response was quite appropriate. I have a vague memory that there have been letters like that in the past. Wouldn't it be nice if there were a way of setting up a dialogue with these people using Pigliucci's Epistemic Virtues?

Jerry Davis
Davis, California

More on 'Why Skepticism?'

Skeptics were criticized (and defended) on their choice of targets ("Why Skepticism?," March/April 2017). I personally enjoy SI's broad debunking of paranormal purveyors, UFOs, creationists, and their ilk. However, John Horgan did touch on a gap that could use a good dose of critical thinking skills. Mainstream media reprint breakthrough drug "studies" and other big pharma–related announcements without qualification. I've yet to see one that differentiated between relative versus absolute risk. For example, the Associated Press distributed an article on the "cholesterol-busting drug" evolocumab. ("Powerful Heart Drug Cuts Risk for Cardiac Patients," 3/18/17). "59% decline in LDL" and "20% reduction in deaths" seem designed to spur fearful patients into clamoring for an expensive new drug ("over $10,000 per year"). However, rudimentary math reveals the benefit is wildly overstated. "For every 200 people treated . . . for roughly two years, three fewer people would suffer a heart attack, stroke or heart-related death." Well, 3 ÷ 200 = 1.5%; ÷ 2 years = .75%/year. So, this drug lowers risk to under 1%/year. But a "20% reduction in [1.5] deaths" means the original risk was barely 1% to begin with (.75% ÷ 80% = .9375%). So the absolute reduction in risk for any one person is less than .2%/year (.9375% - .75% = .1875%).

And that's only among high-risk patients. For every 100 people treated for $1,000,000/year, one and a half people may reduce risk of a second heart attack or stroke by less than 1 percent. Is dosing a large population with hundreds of millions of dollars of a marginal new drug worth it? Society can't make rational decisions on where to spend limited healthcare dollars if we fail to separate ballyhoo from significant effectiveness. Big pharma claims should not escape the same scrutiny you give alternative medicine.

John Clinger
Midlothian, Virginia

Editor's note: Medical educators, science writers, and media critics and observers repeatedly caution against placing too much credence in reports of single studies and in not distinguishing between absolute and relative risks. We have often published similar cautions in SI. Thanks to Mr. Clinger for emphasizing the continuing need.

Regarding "Why Skepticism?," I recently came across an interesting quote:

> The seeker after the truth is not one who studies the writings of the ancients and, following his natural disposition, puts his trust in them, but rather the one who suspects his faith in them and questions what he gathers from them, the one who submits to argument and demonstration, and not to the sayings of a human being whose nature is fraught with all kinds of imperfection and deficiency. Thus the duty of the man who investigates the writings of scientists, if learning the truth is his goal, is to make himself an enemy of all that he reads, and, applying his mind to the core and margins of its content, attack it from every side. He should also suspect himself as he performs his critical examination of it, so that he may avoid falling into either prejudice or leniency.

The author was Ibn al-Haytham, born in 965 CE.

Wayne Hodgins
Cote St Luc, Quebec, Canada

Paulding Light Mystery

I enjoyed Ben Radford's "spot on" column on the "Mystery of the Paulding Light" (March/April 2017). After reading it, I went into my research files (about thirty pages) and noted that at one time the Ripley's Believe-it-or-Not column offered a $100,000 award to anyone who could explain the source of the light!

My wife and I conducted extensive research on the site in 2003. At dusk, we were sitting in the car when the group of about fifteen people who had assembled at the viewing site suddenly screamed, "There it is!" I jumped out of the car with my binoculars and saw not only the light but also the vehicle. We watched for about an hour and noted that red lights were always seen moving slightly upward on the right and white lights were going down on the left. Occasionally both red and white lights appeared simultaneously. Not too great a mystery! We timed the white lights (southbound vehicles) and then vehicles passing our location (the viewing site on Old State Road 45) near U.S. 45. The timing was almost identical in each instance.

But I must admit to having been somewhat confused by one thing: According to the rather detailed map in my possession, there was no road where I thought the lights were seen. This turned out to be an illusion. The towns of Watersmeet and Paulding are almost exactly north/south from one another. Old 45 veers off to the left and in a very straight line from a slight turn in the main highway. It was not until we got home and I went to the library and checked a USGS topographic map that the truth was revealed (you can see this easily on Google Earth or MapQuest, which I find most useful in the study of ghost lights—along with the binoculars, a compass, and a stopwatch).

The belief that Old 45 was headed off in a north-northwesterly direction is an optical illusion because of the slight turn in its path. Actually, the old highway runs north/south. Looking straight northward from the viewing point, the line of sight intersects current U.S. 45 as it goes up/down a hill. The lights are those of vehicles that are visible for about seventy to seventy-five seconds as they travel up/down the hill, a distance of about 1.2 miles. Where is Ripley's $100,000 when needed? It is always possible, of course (as at Marfa), that other lights are occasionally seen. But I am 100 percent confident that the major lights are those of vehicles. So much for the tales of serious research conducted by various agencies in search of the light's source!

Charles (Fritz) Gritzner
Distinguished Professor Emeritus of Geography
South Dakota State University

The Knock Occurrence

In response to Joe Nickell's discussion of the Knock apparitions ("Miracle Tableau, Knock, Ireland, 1879," March/April 2017), it's a pity that his list of references omits David Berman, the emeritus professor of philosophy at Trinity College, Dublin, who was the first, I believe, to find documentary evidence (recorded eyewitness testimony) to support the magic lantern theory; I believe as early as 1979 in *The Freethinker*. In 1987, we republished it in the newly created British Skeptic magazine.

In 1988, in his television documentary "Is There Anybody There?" Karl Sabbagh and his production team performed a persuasive reenactment of the apparitions using a small mirror under the eaves of the church and a magic lantern to reproduce the effect described by eyewitnesses.

Wendy Grossman
Richmond, Surrey, U.K.

Joe Nickell replies:

It is not unusual for debunkers to postulate an elaborate deus ex machina *to "solve" mysteries. One hypothesis held that a medieval forger actually invented photography, utilizing a statue and sensitized cloth, to produce the Turin "shroud" image. Another postulated that the ancient Nazcas of Peru originated hot-air balloons in order to create and fly over their giant ground drawings. These, and other such notions, have often been elaborately demonstrated—usually by very intelligent people who may, however, have missed detective school.*

The article cited lists only "four possible explanations" but misses a fifth (mine) and admits "there are difficulties with the magic lantern hypothesis," including the sky having been "too bright at the time for the projector to work effectively." But that is reinterpreted, and other rationalizations are made. The documentary added a mirror. Nevertheless, an investigating professor found many obstacles to the suggestion, including the fact that detection would have been all but guaranteed "by even the most ignorant" of observers. As for me, I am grateful each day for occam's razor.

Wikipedia

In her excellent Forum column article on Wikipedia ("Let Your Questioning Start with Wikipedia," March/April 2017), Susan Gerbic describes this wonderful resource to combat ignorance. I am always amazed at how easy it is to find an answer, compared to my school age years, when I felt consigned to the World Book Encyclopedia. However, she didn't explain the need for caution. Several years ago, during a Super Bowl, I was curious about the age of the half time rock performer. And there, in the first paragraph, it stated that he was, "born and anally raped…." I was stunned, and actually believed that the poor man had been a victim of sexual abuse. Granted, it seemed an odd way to write it, and lo and behold, the next day, it was edited out. Ms. Gerbic makes the point that statements need to be referenced. And of course then one can search the reference. Nonetheless, it doesn't always stop the unscrupulous from contaminating this incredible resource. Readers need to remain skeptical.

John M. Diamond
Greenville, North Carolina

Susan Gerbic replies:

Thank you. I loved your question so much I've answered it in detail on CSI's website at http://www.csicop.org/specialarticles/show/vandalism_on_wikipedia. Vandalism on Wikipedia is everyone's responsibility.

Healthy Obesity?

After demolishing the idea that it is possible to be healthy and fat with SI's usual combination of footnotes and disdain, Mr. Krause has a concluding paragraph that includes a denunciation of "the misguided and oppressive forces of political correctness," which apparently have suppressed his researches into fat (Science Watch column, March/April 2017). When I hear someone inveighing against "political correctness," observation suggests that the complainer has been told off for saying something rude, vulgar, or demeaning about someone or group of someones. Did Mr. Krause want to refer to fat people as "lazy pigs" or "fat slobs" or some other term and get an editorial smack on the knuckles?

Why has he felt the need to say horrid things to or about people who have heard it all before with the addition of constructive criticism from very earnest people who only have our best interests at heart? If he would just let his facts speak for themselves and remove the personal element—and the complaining about "political correctness"—out of it, I would have found his article interesting and informative.

Kathleen Stipek
Gainesville, Florida

Tai Chi Master

Regarding the column "Claims of Chi: Besting a Tai Chi Master" (January/February 2017).

First of all, one does not have to know about or believe that chi is "magical" to receive the benefits of practicing Tai Chi. The article would be better titled "Claims of a Tai Chi Master," as it is not really about Tai Chi as practiced in much of North America today. The masters I know simply teach one or more of the Tai Chi forms and other breathing exercises. They may or may not talk about the history of Tai Chi and its relationship to other martial arts. There are many articles that describe the health benefits of practicing Tai Chi. Among others are: *The Harvard Medical School Guide to Tai Chi: 12 Weeks to a Healthy Body, Strong Heart, and Sharp Mind* (Harvard Health Publications) by Peter Wayne (2013); "A Comprehensive Review of Health Benefits of Qigong and Tai Chi," Roger Jahnke et al. *American Journal of Health Promotion*. July/August 2010 24(6):e1-e25; The CDC Compendium of Effective Fall Interventions: What Works for Community-Dwelling Older Adults, 3rd Edition, is a collection of effective fall interventions available on the CDC's website and is designed to help public health practitioners, senior service providers, clinicians, and others who want to address older adult falls in their community.

Jeanne Sebaugh
Columbia, Missouri

Joe Nickell replies:

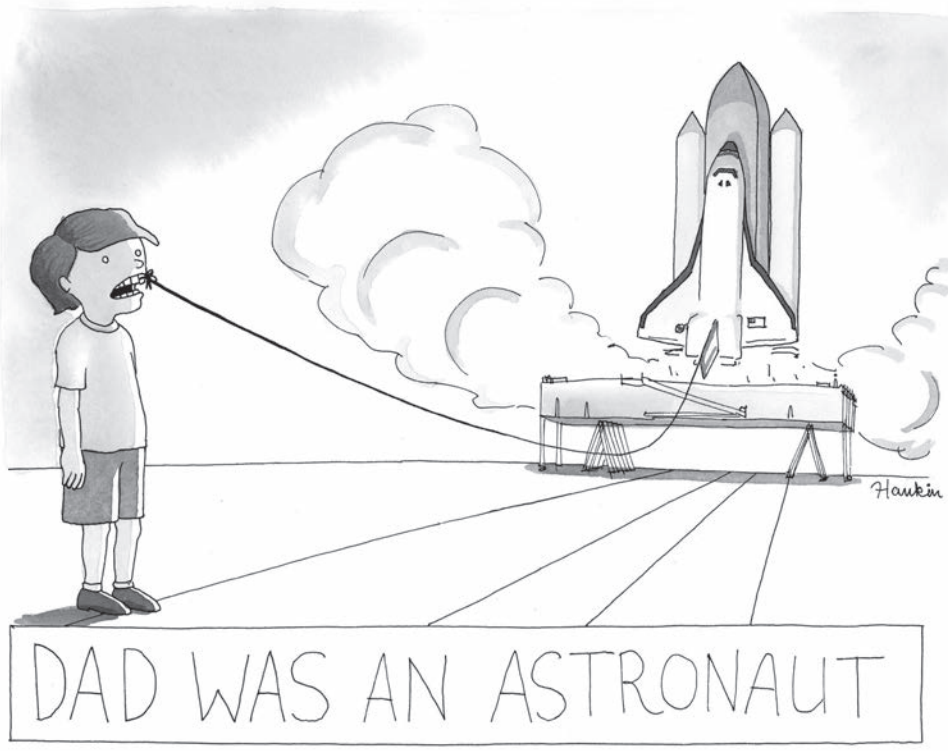
My article was not a dismissal of tai chi as having no redeeming value. I wrote that "I found plausible the claims that the practice could help reduce stress and tone muscles." However, I exposed not just one master's claim but several, and I repeat: "Many unsupported claims are made for the magical, invisible chi—whose existence itself is unsupported by science."

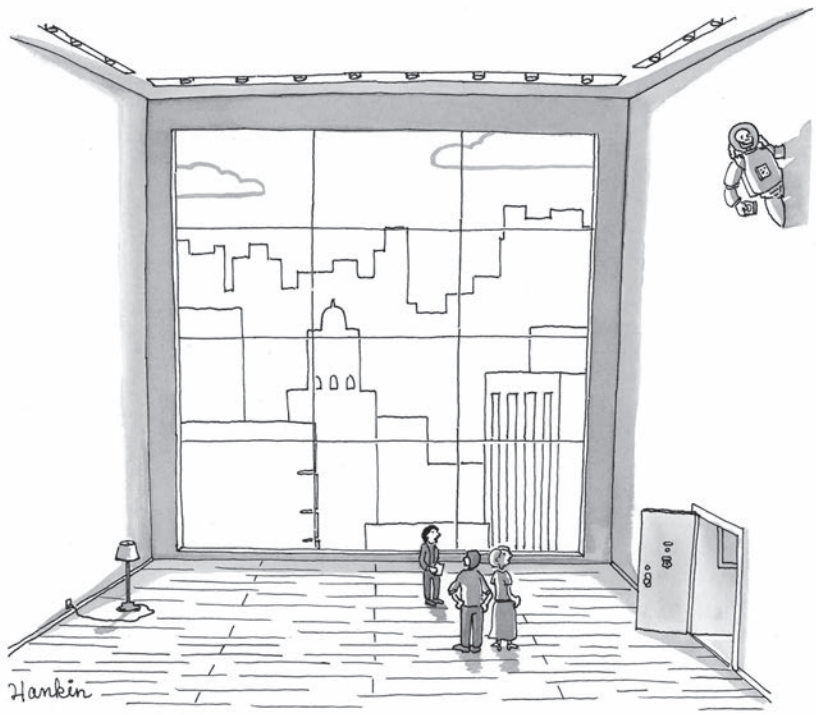
Cover Art

A note from Editor Kendrick Frazier: Some readers objected to the cover art on our March/April 2017 issue, saying the graphic used did not accurately portray a DNA molecule. We appreciate the critical insight, but we did not say it was a DNA molecule. It was merely intended to give a general sense of something about the article's topic. The article, by Richard Dawkins, was about the gene's eye view of evolution, a rather difficult thing to illustrate literally, I think you will agree. It was not about the structure of DNA or structural biology. It seems to me that we have two main types of art in SI: some (often provided by the author) is scientific/technical/ informational, goes specifically with an article, and is intended to impart useful information about some aspect of it. In contrast, our cover art is often stock art chosen not for its literal content but for its literal content but for its aesthetic quality or visual appeal. We hope it attracts your eye and brain to the issue's content and message. That was, and is, our intention at any rate.

[FEEDBACK

The letters column is a forum on matters raised in previous issues. **Letters should be no longer than 225 words**. Due to the volume of letters we receive, not all can be published. Send letters as email text (not attachments) to letters@csicop.org. In the subject line, provide your surname and informative identification, e.g.: "Smith Letter on Jones evolution article." Include your name and address at the end of the letter. You may also mail your letter to the editor to 944 Deer Dr. NE, Albuquerque, NM 87122.





"Of course, what you're really paying for is the mummified time traveler."

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The organizations listed above have aims similar to those of the Committee for Skeptical Inquiry but are independent and autonomous. Representatives of these organizations cannot speak on behalf of CSI. Please send updates to Barry Karr, P.O. Box 703, Amherst NY 14226-0703.
International affiliated organizations listed at www.csicop.org.

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